Issues in Pension Policy:

Demographic and Economic Aspects of Canada's Ageing Population

The Economics of Financing National Pension Plans

The Financing of Public and Private Pension Plans: An Analysis from Two Perspectives

Staff Paper

Ontario
Ministry of Treasury and Economics
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Ontario Proposals For Tax Reform In Canada

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Copies may be obtained from the
Taxation and Fiscal Policy Branch,
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Preface

The economics and financing of pension plans in Canada is a current issue of major importance in public finance. In potential magnitude and impact, it rivals national tax reform of the early seventies.

Tax reform was an extremely complicated exercise that required substantial original research to assist the formulation of public policy. Ontario has contributed significantly to this process. Since 1970, the Province has published a series of technical studies in the fields of taxation policy and related areas.

Beginning in 1972, Ontario began to publish the results of its analyses of public pensions. These studies dealt primarily with issues relating to the financing of the Canada Pension Plan. In 1978, the Government of Ontario established the Ontario Royal Commission on the Status of Pensions to examine public and private pensions, in recognition of the broader scope of pension concerns.

In the spirit of its earlier studies in tax reform, the Government is publishing in this document the results of exploratory staff research in key areas of pension policy. It is number 16 in the series of Ontario Treasury Staff Studies in Public Finance.

This document comprises three studies.

The first study, **Demographic and Economic Aspects of Canada's Ageing Population,** explains the rate of fertility as a determinant of a population's age structure and highlights the uncertainty surrounding population projections. With this as background, some economic consequences of demographic ageing including future shifts in the composition of Canada's "dependent" population are examined.

The second study is entitled **The Economics of Financing National Pension Plans.** This study outlines the economic principles which underlie the two basic methods of financing national pension plans. It is emphasized that the choice between pay-as-you-go and investment fund financing can affect the economy's saving rate and this in turn affects Canada's future economic growth.

The Financing of Public and Private Pension Plans: An Analysis from Two Perspectives is the last study. It describes the inherent interrelationship between pay-as-you-go and investment fund financing. With this preparation, the financing options for national and employer-sponsored pension plans are examined using both financial and economic criteria.

These studies do not present policy positions with respect to the financing of public, private or national pension plans. The purpose of this publication is to present particular pension issues in a consistent economic framework while simultaneously documenting Ontario's understanding of the issues. It is anticipated that this document will be useful in discussions surrounding the forthcoming report of the Royal Commission on the Status of Pensions in Ontario.

These studies were prepared by the Pension Policy Section of the Taxation and Fiscal Policy Branch. The papers were written by J. H. Ilkiw with the assistance of J. S. Dennis, S. L. Malloy, and supervised by D. A. Stouffer, Senior Budget Advisor.

B. Jones,
Executive Director,
Fiscal Policy Division

B. Smith,
Director,
Taxation and Fiscal Policy Branch

Demographic and Economic Aspects of Canada's Ageing Population

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Introduction

Elderly people will make up an increasing proportion of Canada's population over the next five decades. This demographic phenomenon has raised concern about the ability of Canadian society to accommodate the necessary economic and social adjustments accompanying population ageing.[1]

To evaluate this issue the paper examines some of the principal demographic and economic aspects of ageing. Section I describes the future age composition of Canada's population under various demographic assumptions. This is followed by a discussion of the determinants of fertility and the uncertainty about its future behaviour.

Section II illustrates some economic aspects of population ageing by examining dependency rates, the saving rate and the adjustment period.

The analysis indicates:

- Canada's population will age but the degree of ageing remains uncertain because future fertility behaviour is uncertain.
- Resources will shift from supporting young dependents to supporting aged dependents and in the near future (to 1995) total dependency will likely be less than current levels.
- Whether or not total dependency in the distant future (1995-2031) will exceed current levels cannot be unequivocally determined.
- Shifts in the age distribution of Canada's population may have an initial positive impact on personal saving and then a negative impact as the members of the "baby boom" pass into the post-65 age group.
- The transition to an aged population will take over four decades; this lengthy adjustment period is advantageous, allowing not only a gradual reallocation of resources from young dependents to aged dependents, but also concurrent social, economic and technological developments which will mitigate problems resulting from demographic ageing.

The material examined indicates the initial consequence of the transition to an aged population is a reduction in the relative number of young and aged dependents. This suggests that in the near future, over the next fifteen years, the rate at which resources need be transferred from the working population to their economic dependents will be correspondingly reduced. However, as the elderly increase as a percentage of the population, especially in the years subsequent to 2010, the total rate of economic dependency will also increase. Whether this increased responsibility will unduly strain Canada's productive capacity or disrupt its social stability cannot be determined, but considering the economic and technological advances that can be reasonably expected, a pessimistic view of the future is unwarranted.

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[1]Calvert, G., *Pensions and Survival: The Coming Crisis of Money and Retirement* (Toronto: Maclean-Hunter, 1977).

I. The Demographic Aspects of Ageing

1. The Dynamics of Canada's Ageing Population

The long term consequence of a constant fertility[2] rate, a constant mortality rate and no immigration is a population growing at a constant rate with an **unchanging age distribution.** Such a population is described as being **stable.**[3]

In response to a permanent decline in fertility, an initially stable population will undergo a long period of adjustment in age composition before it again stabilizes at a lower growth rate. Although the now more slowly growing population also possesses an unchanging age distribution, its structure will have **aged.** That is, the number of elderly individuals will have increased as a proportion of the total population. Canada, with its baby boom bulge moving through the age categories, exemplifies a country which is demographically ageing.

A population in which there is a long run decline in the fertility rate will experience an easy transition to its new higher average age. However, in the Canadian context the secular decline in the fertility rate that was observed in the pre-war years was quite suddenly interrupted after the war. In 1939 the total fertility rate was 2.7. The rate was 3.2 in 1946 and it peaked in 1959 at just over 3.9. By 1975 the rate had declined to 1.8.

Compared to the 1939 level, Canada's fertility rate of 1.8 in 1975 is the precondition for an ageing population. However, the adjustment process to an older population must assimilate the war-baby bulge which complicates the adjustment process. For this paper, the war-baby bulge is considered to be spread over the 20-year period 1946 to 1965 during which the fertility rate always exceeded 3.0.

Given a known decline in fertility, the transition to an older population is characterized by marked and predictable shifts in age distribution. Projections of Canada's future age structure under various demographic assumptions are presented in Table 1.[4] The first projection assumes a low fertility rate of 1.8 and annual net immigration of 60,000 persons. Medium and high fertility assumptions are 2.2 and 2.6 respectively. The corresponding net immigration assumptions are 60,000 and 100,000 persons.[5]

Changing Age Composition of Canada's Population — Table 1
(per cent)

	Actual		
Year	0–14	15–64	65+
1925	33.49	61.45	5.06
1935	30.16	63.85	5.99
1945	27.63	65.30	7.07
1955	32.10	60.16	7.74
1965	33.38	58.95	7.67
1975	26.29	65.18	8.53

	Projected								
Year	Low Fertility 1.8 Net Immigration 60,000			Medium Fertility 2.2 Net Immigration 60,000			High Fertility 2.6 Net Immigration 100,000		
	0–14	15–64	65+	0–14	15–64	65+	0–14	15–64	65+
1985	22.01	68.03	9.95	24.38	65.97	9.66	26.71	64.07	9.22
1995	21.22	67.36	11.42	24.51	64.71	10.78	27.59	62.49	9.21
2005	18.70	69.42	11.89	22.10	67.07	10.83	25.42	65.00	9.57
2015	17.91	68.11	13.98	22.20	65.60	12.19	26.35	63.29	10.35
2025	17.31	64.63	18.06	21.63	63.34	15.02	25.75	61.97	12.27

Source: Statistics Canada

[2]Fertility is the expected average births per female over her lifetime.
[3]For a detailed discussion of demography and population ageing, see Frejka, T., *The Future of Population Growth* (New York: Wiley, 1973) and Pressant, R., *Demographic Analysis* (New York: Aldene-Atherton, 1972).
[4]Statistics Canada, *Population Projections for Canada and the Provinces: 1972-2001,* Catalogue No. 91-514 and unpublished projections to 2025.
[5]Immigration affects a population's age distribution. For simplicity, this discussion ignores the impact of immigration.

Over the observed period 1925-1975, the proportion of Canada's population aged 65 and over rose from 5.06 per cent to 8.53 per cent. The projections presented in Table 1 indicate the aged will rise to between 12.27 per cent (with high fertility) and 18.06 per cent (with low fertility) of Canada's population by 2025. Thus, over the next five decades, the aged as a proportion of Canada's population are expected to increase by between 44 and 112 per cent.

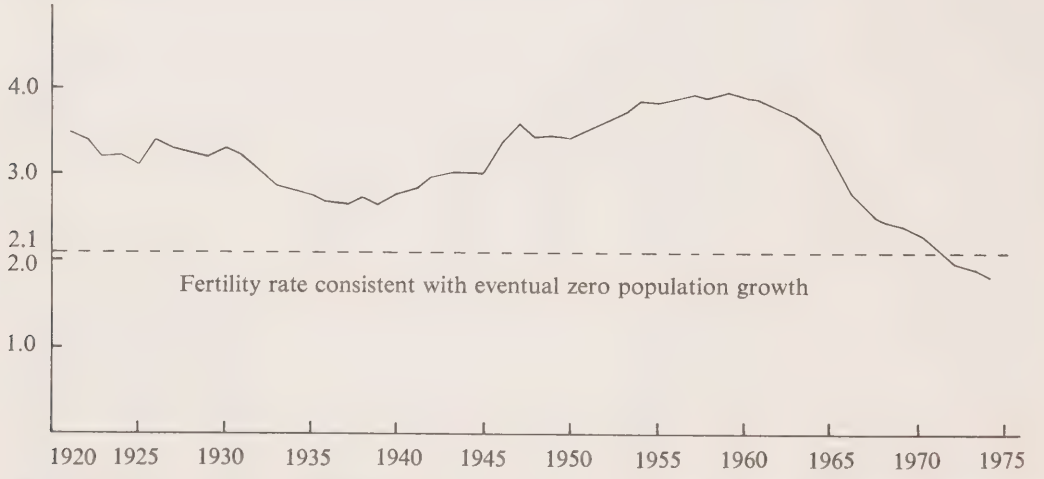
The three projections also reveal that the percentage of individuals that are aged rises most significantly between 2015 and 2025. This reflects the shift of the post-war baby boom bulge into the 65-plus age category. The magnitude of the increase in the percentage of aged is related to the fertility assumption employed in the projections. The lower the fertility rate, the greater is the assumed decline in fertility relative to the 25-year post-war average, and the more pronounced is the baby boom bulge and its subsequent impact on the age profile in 2025.

It should be noted that the number of individuals that will comprise Canada's aged population in 2025 remains essentially unchanged under any fertility assumption, due to the fact that all persons aged 65-plus in 2025 were born prior to 1960. The changing **proportion** of elderly individuals is a function of the impact of fertility on total population. A high (low) fertility rate will induce a larger (smaller) increase in the total population which in turn makes the population younger (older).

The above projections and the description of a population moving towards a new position of demographic stability assume constant fertility rates. This assumption, though useful for making population projections, does not reflect the uncertainty surrounding future fertility rates.

Table 2 records the annual observed total fertility rate for Canada from 1921 to 1975. The average over the 25-year post-war period was 3.7. In 1966, the fertility rate dropped below 3.0, declined steadily and was recorded at 1.9 in 1974. The average over the period 1966-74 was 2.3. For a point of reference, a 2.1 fertility rate will eventually yield zero population growth.

Total Fertility Rate,[1] 1921-1975 — Table 2



[1]Expected average births per female over her lifetime.
Source: Statistics Canada.

Besides illustrating fertility to be variable, Table 2 highlights that its marked decline has only been a recent phenomenon. Although the consensus is that Canada will continue to experience relatively low fertility rates, it is not clear whether the very low rates currently observed are truly indicative of the future. For this reason, a spectrum of population projections has been presented and analyzed. In this way, the sensitivity of a population's age distribution to possible changes in fertility behaviour is identified.

2. Determinants of Fertility Behaviour

The determinants of fertility behaviour have long been the subject of investigation by both demographers and economists. Two contradictory schools of thought have prevailed among demographers. One is that economic development ultimately inhibits fertility; the second is that economic development promotes fertility.[6]

The first view is presently the most widely held. It contends that fertility is a function of a nation's state of economic development and, as a consequence, there is a process of demographic transition. A pre-industrialized country is characterized by high fertility and high mortality resulting in slow population growth. An industrializing nation experiences high fertility combined with rapidly declining mortality and a consequent high population growth rate. And finally, the highly industrialized nation has both low fertility and mortality with little or no population growth. Canada is considered to be in the third stage of demographic transition.

The competing view that economic development promotes fertility has empirical support as does the demographic transition hypothesis. Various statistical studies have shown fertility to be directly related to the business cycle as well as to relatively high wage levels paid men 20 to 29 years of age. The latter result is used to explain the rise in fertility in Canada and the United States during the 1945-1960 post-war period.[7]

In an effort to reconcile the two opposing theories, a third hypothesis has been proposed.[8] It suggests that while fertility and economic development are positively related, there are attendant aspects to economic development which discourage fertility. In the long run, the forces discouraging fertility tend to be stronger than the forces encouraging fertility. The principal aspects of economic development discouraging fertility include increased knowledge and use of birth control and a rising economic opportunity cost of bearing and rearing children.

This demographic hypothesis is buttressed by the theoretical and empirical research undertaken by economists.[9] It is postulated that the decision process to bear children closely resembles the acquisition of other durable "goods" by the household unit. The desire for children is related directly to income and inversely with price. The income of the household head is the income variable, and the price variable is the opportunity cost of the spouse's time and all other costs associated with having children.

The recent and pronounced change in the career aspirations of women, as exemplified by their increased labour force participation, creates a rapid rise in the opportunity cost of motherhood. Add to this the time, effort and financial resources that must be expended preparing progeny for an increasingly complex and demanding society, and it is understandable why the decline in fertility is attributed to the economic cost of having children. Further, considering the cost of child rearing will likely not decline in the near future, the consensus that Canada's population will age is not unreasonable.

Although it is reasonably certain that fertility will remain low relative to Canada's historical experience, the long run magnitude of the decline is not predictable. To the extent current behaviour reflects uncertain economic times and an increased relative cost of acquiring household capital, a stabilization of economic conditions and a reduction in the real cost of housing may promote fertility. Also, to the extent women have only postponed child bearing in order to capitalize on significant investments in education or fulfill career aspirations, an increase in future fertility rates can be

[6]For a summary of views held by demographers see Heer, D., "Economic Development and Fertility", *Demography*, 1966, Vol. 3, No. 2.
[7]Easterlin, R., *The American Baby Boom in Historical Perspective* (New York: National Bureau of Economic Research, 1962).
[8]Heer, *op. cit.*
[9]Becker, G., "An Economic Analysis of Fertility", *Demographic and Economic Changes in Developed Countries* (Princeton: Princeton University Press, 1962); Cain, G. and A. Weininger, "Economic Determinants of Fertility: Results from Cross-Sectional Aggregate Data", *Demography*, 1973, Vol. 10, No. 3; Shultz, T. (Ed.) "Marriage, Family Human Capital and Fertility", *Journal of Political Economy*, 1974, Vol. 82.

expected. It is also possible that the economic cost of having children could be lowered by increased centralization of child rearing responsibilities through expanded daycare services and the use of parental surrogates possessing specialized skills.

Canada's population is demographically ageing, but the degree of ageing is uncertain. Noting its historical variability and the lack of a full understanding of its determinants, a moderation in the recent decline in fertility should not be considered unrealistic and, by implication, the pattern of ageing immutable.[10]

[10]Sklar, J. and B. Berkov, "The American Birth Rate: Evidence of a Coming Rise", *Science*, August, 1975.

II. Economic Consequences of Ageing

During the transition to a lower long run growth rate, a population's age structure will undergo fundamental shifts in composition. Three important variables through which the changing age profile can affect the economy are: dependency rates, the saving rate and the adjustment period.

1. Dependency Rates

The concept of dependency has traditionally been the main focus of demographic-economic interactions. Young and old individuals are considered to be relatively less productive and require their consumption to be supported by efforts of the productive segment of an economy's population. The number of young and old in a population expressed as a percentage of the individuals of working age is a crude measure of an economy's **total** dependency. By distinguishing between the two components of the total dependency rate, similar measures of youth and aged dependency can be calculated.

(i) Projected Crude Dependency

Table 3 presents past and projected future dependency rates for Canada.[11] The projection selected assumes a long run average fertility rate of 1.8 births per woman and a net gain from immigration of 100,000 persons per annum.

The impact of the low fertility rate is reflected in the steady decline in youth dependency and an increase in aged dependency. It should be noted that aged dependency rises slowly and steadily from 1976 to 2011 but increases significantly between 2011 and 2031. This marked increase reflects the ageing of the post-war baby boom. Subsequent to 2031 the aged and youth dependency stabilize at about 30 and 35 per cent respectively. The corresponding total dependency rate is 65 per cent.

Dependency Rates for Canada, 1901 to 1971 Table 3
Projections 1976 to 2071
(per cent)

Year	Pop'n 65+/ 18–64	Pop'n 0–17/ 18–64	Total Dependency
1901	9.3	74.9	84.2
1911	8.2	68.2	76.4
1921	8.7	72.6	81.3
1931	9.8	66.6	76.4
1941	11.2	56.5	67.7
1951	13.5	60.8	74.3
1961	14.3	72.8	87.1
1971	14.4	63.4	77.8
1976	14.4	52.8	67.2
1981	14.8	44.9	59.7
1986	15.4	41.6	57.0
1991	16.7	41.1	57.8
1996	17.4	40.3	57.7
2001	17.5	37.6	55.1
2011	18.7	33.9	52.6
2021	25.0	34.6	59.6
2031	31.7	35.0	66.7
2041	30.3	34.4	64.7
2051	30.6	34.7	65.3
2061	31.0	34.6	65.6
2071	30.6	34.7	65.3

Source: Statistics Canada

A comparison of Canada's projected dependency rates with past experience yields three significant observations:

- Aged dependency, which has slowly increased since 1911, will increase rapidly only after 2011.
- Youth dependency is presently lower than any time in the past and will decrease even more in future.

[11]Statistics Canada, *Social Security*, Catalogue No. 86-201, 1978.

- Total dependency will be below historical levels over the next 50 years and will approach current levels only after 2031.

These observations suggest that:

- Over the next century a smaller share of resources will be needed to support the young and a larger share will be needed to support the aged.
- The major increase in aged dependency will not occur until after 2011, more than 30 years into the future.
- The increasing aged dependency is more than offset by a decline in youth dependency, thus lowering the total dependency rate.

If the crude dependency rates in Table 3 are accepted as a reasonable measure of the economic responsibilities to be faced by Canada's future working-age populations, it would seem that their total responsibilities will be relatively light when compared to their historical counterparts, including the current working-age population. Total dependency will decline in the near future and only increase after the first decade of the next century, and then to a level that is well below Canada's historical experience.

(ii) Projected Effective Dependency

A more realistic approach to estimating dependency should recognize that per capita costs of supporting old and young dependents are not necessarily equal. To obtain a more accurate picture of dependency, the number of old and young should be weighted by their respective per capita support costs. In this way a measure of **effective dependency** is obtained.

Although estimates of the total public and private cost of supporting dependents are not available, there are measures which can serve as reasonable proxies. One such measure is age-related per capita government sector expenditures on health, education and social welfare programs. A federal study by the Treasury Board Secretariat estimated that 1976 per capita expenditures of the three levels of government for individuals aged 65 and over were $4,745 while per capita expenditures on the segment of the population aged 0–17 were $1,909.[12] Per capita government sector expenditures on the aged were 2.5 times per capita expenditures on the young.

Accepting that age-related government sector expenditures adequately reflect the relative economic costs of supporting young and old dependents, effective dependency rates can be calculated. Table 4 compares projected crude and effective dependency rates.[13] Dependency rates have been normalized with respect to 1976.

As noted previously, the selected projection indicates total crude dependency will be below the 1976 norm despite the steadily increasing proportion of aged individuals. But when effective dependency rates are projected, there is a significant turnabout: total dependency exceeds the 1976 norm in 1991 and by 2031 the norm is exceeded by 43

[12]"Changing Population and the Impact on Government Age-Specific Expenditures" (Ottawa: Planning Branch Effectiveness Evaluation Division, Treasury Board Secretariat, 1977). Per capita costs for individuals aged 0–17 and 65-plus are derived from Table A10 of Appendix A and Table 9 of Appendix C. The study does not provide a categorical breakdown of government sector expenditures on the 0–17 and 65-plus age groups. However, an appreciation for their relative magnitudes can be gained by examining the per capita program cost of the 0–14 and 65-plus age groups.

Estimated Age-Related Per Capita Cost By Major Program, 1976

Program	Age Group	
	0–14	65-Plus
Family Allowance	302.01	—
Hospital Care	108.14	1,149.54
Medical Care	68.38	166.47
Canada Assistance Plan	144.52	432.84
Education	1,235.57	—
GIS	—	531.59
OAS	—	1,695.13
Total	1,858.62[1]	3,975.57[1]

[1]Total excludes estimated CPP per capita costs.

per cent. In contrast to the previous conclusion, projected effective dependency rates suggest future working-age populations will be required to transfer a larger proportion of their income to support the consumption of the old and the young than that required by the present generation.

Implicit in this projection of effective dependency rates is the assumption that per capita support costs grow at the same rate as the per capita income of the working-age population. This may not be the situation. It is possible that dependency costs will not grow at the same rate as per capita income. For example, if support costs grow at 1.0 per cent less than per capita income, projected total dependency rates do not exceed the 1976 norm. By the year 2031, the total effective dependency burden is only 96 per cent of the 1976 norm. Conversely, if support costs grow more rapidly than per capita income, future working-age populations will be required to transfer even a larger proportion of their income to their economic dependents than is suggested by the relative dependency rates recorded in line 2(a) in Table 4.

Projected Dependency Rates Relative to 1976 — Table 4

	1976	1981	1991	2001	2011	2021	2031
1. Relative Crude Dependency Rates							
Total	1.00	0.89	0.86	0.82	0.78	0.89	0.99
Aged	1.00	1.03	1.16	1.22	1.30	1.74	2.20
2. Relative Effective[1] Dependency Rates							
(a) Equal Growth							
Total	1.00	0.98	1.02	1.01	1.02	1.20	1.43
Aged	1.00	1.14	1.40	1.48	1.59	2.11	2.72
(b) 1% Growth Differential							
Total	1.00	0.94	0.89	0.82	0.78	0.86	0.96
Aged	1.00	1.08	1.23	1.23	1.24	1.56	1.85

[1]Assuming 1.8 fertility rate and net immigration of 100,000.

Projected dependency rates clearly indicate resources will shift from supporting the young to supporting the aged. What is not clear is the relative magnitude of economic responsibility to be faced by Canada's future working-age population. If the aged are relatively more costly to support than the young, and if the per capita support costs grow at the same rate as per capita income, an increasing proportion of the working-age population's income will be transferred to their economic dependents. However, with a favourable differential in the per capita growth rates of income and support costs, financial responsibilities of future workers will be alleviated. On the other hand, less favourable circumstances would significantly increase the economic responsibilities of future workers.

(iii) The Pay-as-you-go Pension Plan: A Transfer Mechanism Sensitive to Population Ageing

Both the crude and effective aged dependency rates indicate economic resources will be shifted to support the elderly as the population ages. One type of program designed to support the elderly which is explicitly affected by demographic ageing is the pay-as-you-go pension plan financed by an earmarked payroll tax.

Under pay-as-you-go financing, pensions received by the elderly are taxes (compulsory pension contributions) collected from the working population. The tax rate is determined by the pension benefit provided and the number of pensioners relative to the size of the employed labour force. With a given pension benefit, say 25 per cent of the average wage, the higher the ratio of pension recipients to contributors, the higher the

[13]A summary of the methodology employed by the Treasury Board Study is as follows:
(i) Per capita federal, provincial and municipal expenditures were estimated for three age groups 0–17, 18–64 and 65-plus for the year 1976.
(ii) With the assumption that per capita expenditures do not change, future aggregate age-specific expenditures were projected by multiplying 1976 per capita costs by the number of individuals estimated to be in the respective age groups under alternative demographic projections.
(iii) To measure total economic dependency, it was assumed the whole of GNP accrues to the population aged 18–64. Future GNP was projected using the rate of growth of the working-age population. The ratio of total government expenditures to young and old dependents to GNP provides a measure of total economic dependency.

tax rate. This follows from the fact that there are simply fewer people over which to spread the cost.

Table 5 illustrates the impact of demographic ageing on the pensioner-labour force population ratio and its corresponding impact on the pay-as-you-go contribution rate. The example universal pension system provides a benefit that is 25 per cent of earnings. The contribution rate is expressed as a percentage of earnings. The pensioner ratio is the number of individuals aged 65-plus divided by individuals aged 15 to 64.

Impact of Population Ageing on Pensioner Ratio and Pay-as-you-go Tax Rates[1] — Table 5

	Low Fertility 1.8 Net Immigration 60,000		Medium Fertility 2.2 Net Immigration 60,000		High Fertility 2.6 Net Immigration 100,000	
Year	Pensioner Ratio	Tax Rate	Pensioner Ratio	Tax Rate	Pensioner Ratio	Tax Rate
		(%)		(%)		(%)
1975	.1309	3.27	.1309	3.27	.1309	3.27
1985	.1463	3.66	.1464	3.66	.1439	3.60
1995	.1696	4.24	.1665	4.16	.1587	3.97
2005	.1712	4.28	.1615	4.04	.1473	3.68
2015	.2052	5.13	.1858	4.71	.1636	4.09
2025	.2795	6.99	.2372	5.94	.1869	4.67

[1]Assumes a universal pension equal to 25 per cent of average earnings.

As can be seen, the pensioner ratio and the tax rate are not greatly affected during the first 15 years of the three projections. Since it takes 15 years for a new birth under the selected fertility assumptions to reach labour force age, projections of the pension ratio in the short run are reasonably accurate. The slightly lower pensioner ratio and tax rate under the high fertility assumption reflects the higher net immigration rate embodied in the projections.

Commencing about 1995, the different fertility assumptions reveal their impact on the size of the labour force and consequently on the pensioner ratio and the pay-as-you-go tax rate. Under low fertility, to provide the same relative benefit in 2025 as established in 1975, the tax rate will have to more than double from 3.27 per cent to 6.99 per cent. Under medium fertility, the tax rate would have to increase 82 per cent. Even with higher fertility and immigration, the pay-as-you-go contribution rate would still rise from 3.27 to 4.67, an increase of 43 per cent.

Although the pay-as-you-go tax rate is actually determined by the ratio of pensioners to **employed** members of the population, the demographic ratios in Table 4 highlight the sensitivity of earmarked pay-as-you-go contribution rates to the extent of population ageing.[14] This sensitivity is not surprising since ageing changes the distribution of workers and pensioners upon which the pension plan contribution rate is determined.[15]

2. Aggregate and Personal Saving Behaviour

Saving behaviour, since it determines the rate of capital accumulation, is fundamental to a society's economic development. As Canada's population ages, the demographic shifts may affect both aggregate and personal saving rates. Aggregate saving will be negatively affected if Canada's ageing population requires increased rates of "committed" consumption. And, if personal saving behaviour is adequately represented by the Life Cycle Theory of Saving and Consumption,[16] the projected changes in Canada's population will also affect personal saving, a major component of aggregate saving.

[14]In contrast, a fully funded pension plan possesses a contribution rate which is not affected by demographic shifts.

[15]Unemployment and labour force participation also affect the pay-as-you-go tax rate through their impact on employment. With a given number of pensioners, the tax rate is positively related to the unemployment rate and negatively related to the labour force participation.

[16]Ando, A. and F. Modigliani, "The 'Life Cycle' Hypothesis of Saving: Aggregate Implications and Tests", *American Economic Review*, Vol. 53, 1963.

(i) Aggregate Saving and "Committed" Consumption

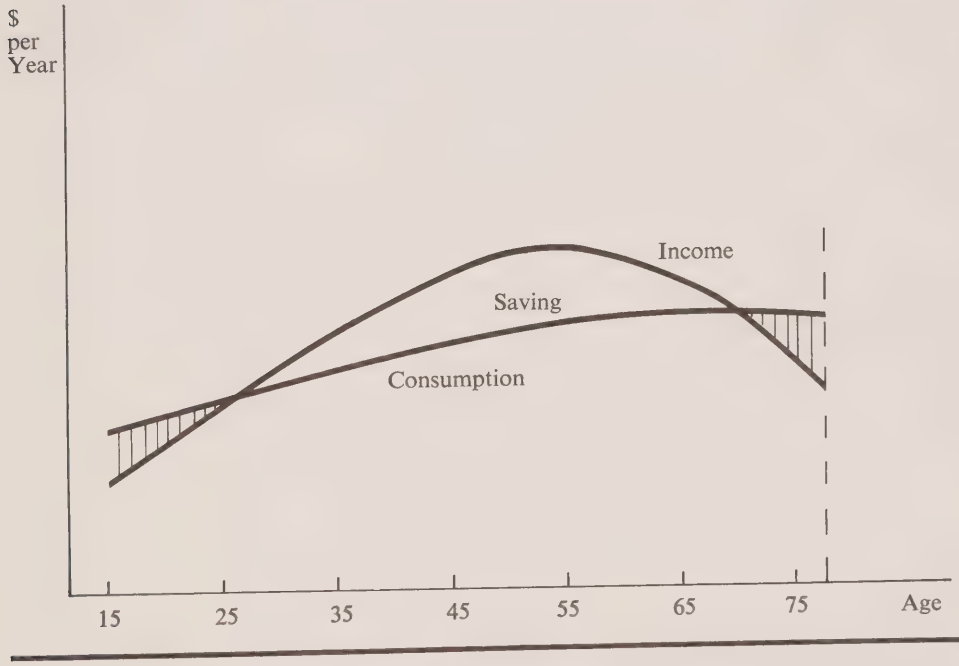
The concepts of "committed" consumption and economic dependency are essentially identical. The income transferred from workers to fulfill the consumption needs of dependents measures effective total dependency and can be viewed as an economy's predetermined "committed" amount of consumption. As demographic shifts occur, dependency rates fluctuate and the amount of output that is committed to consumption changes accordingly.[17]

How committed consumption will affect aggregate saving depends upon the effective total dependency rate. An increase in total dependency increases committed consumption and necessarily reduces the proportion of aggregate income saved. Such a scenario is illustrated by Projection 2(a) in Table 4. On the other hand, if per capita costs of supporting aged and young dependents are equivalent, or if per capita dependency costs do not rise as fast as per capita income, future rates of committed consumption may result in an increased aggregate saving rate. Projections 1 and 2(b) of Table 4 illustrate these scenarios.

(ii) Demographic Shifts and Personal Saving

Under the Life Cycle Hypothesis of Saving and Consumption, an individual's lifetime consumption pattern is not matched by his income stream. An individual's initial working years and retirement years are characterized by relatively low incomes while the most productive middle years are characterized by relatively high incomes. In order to maintain a satisfactory pattern of consumption over the life cycle, young individuals borrow against future incomes, middle-aged individuals save for retirement and the aged draw down accumulated savings. As a consequence, young and old households have relatively low saving rates compared to middle-age and pre-retirement households. A simple pattern of life cycle saving and consumption is depicted in Figure 1.

Life Cycle Pattern of Income, Consumption and Saving — Figure 1



With this microeconomic view, the proportion of personal income saved is age-related and it follows that the aggregate personal saving rate depends on the population age distribution. If the middle-age group dominates, the aggregate personal saving rate would be relatively high. In contrast, if the age distribution is skewed to either end of the

[17]Leff, N., "Dependency Rates and Savings Rates", *American Economic Review*, Vol. 59, 1969.

age spectrum, the saving rate would be relatively low. Thus, as Canada's population ages, the personal saving rate will be positively affected as the members of the baby boom move into the middle-age category and then negatively affected as it enters the post-65 age group. The saving rate will stabilize with respect to demography when the age distribution stabilizes.

(iii) Illustration of the Impact of Population Shifts on Personal Saving[18]

Figure 2 illustrates the relationship between the personal saving rate (PSR) and shifts in the age distribution as represented by past and projected youth (YDR) and aged (ADR) dependency rates. The projected values of ADR and YDR assume a fertility rate of 1.8 and net immigration of 60,000.[19]

A decreasing YDR reveals a population shift towards the middle and pre-retirement age groups which, under the life cycle hypothesis, are characterized by a relatively high propensity to save. As a consequence, a declining YDR will have a positive impact on aggregate personal saving.

An increasing ADR is also indicative of an ageing population. A relative increase in the number of aged individuals will have a negative impact on aggregate personal saving.

It is emphasized that the rates of personal saving plotted in Figure 2 illustrate the impact of demography on saving behaviour. They are not equal to past observed values and are not intended to be forecasts. The effects other economic variables have on the saving-consumption decision have been excluded.

From 1950 to 1965 the steadily increasing ADR and rapidly rising YDR had a negative impact on personal saving. The decline in the youth dependency rate after 1965 reflects the drop in fertility and the movement of the baby boom into the saving oriented middle-age population group. As a consequence, there is a growing positive demographic impact on personal saving. By 1985, the negative effect of an increasing proportion of aged individuals on saving matches the positive effect of the baby boom moving through the high saving years. Subsequent to 1985, the ADR variable increases as the assumed low fertility rate affects the growth of the working-age population and the positive demographic influence on saving declines.

In the year 2010 the first members of the baby boom enter the 65-plus age category. As indicated by the plot of the ADR variable, this results in a pronounced and steady increase in the percentage of the population characterized by relatively low personal saving rates. This phenomenon, combined with a stabilizing YDR, will have a substantial negative impact on aggregate personal saving.

Although the Life Cycle Theory of Saving indicates the rate of personal saving is sensitive to demography and will be negatively influenced by Canada's ageing population, the inference should not be drawn that this is an adverse development. First, the influence of other determinants of saving behaviour such as interest rates, uncertainty, retirement practices and income have been ignored. Future rates of personal saving will depend as much upon these factors as upon demography. Second, it is not clear what constitutes an "appropriate" demographic influence on saving behaviour. If a population is actually declining, as is the situation under the projection used in the current analyses, a low personal saving rate may not be unreasonable. Third, the personal sector is only one source of saving. The public, corporate and foreign sectors also save and a reduction in saving by one sector may be offset by an increase in another, thus keeping the overall rate of saving relatively immune to demographic shifts.

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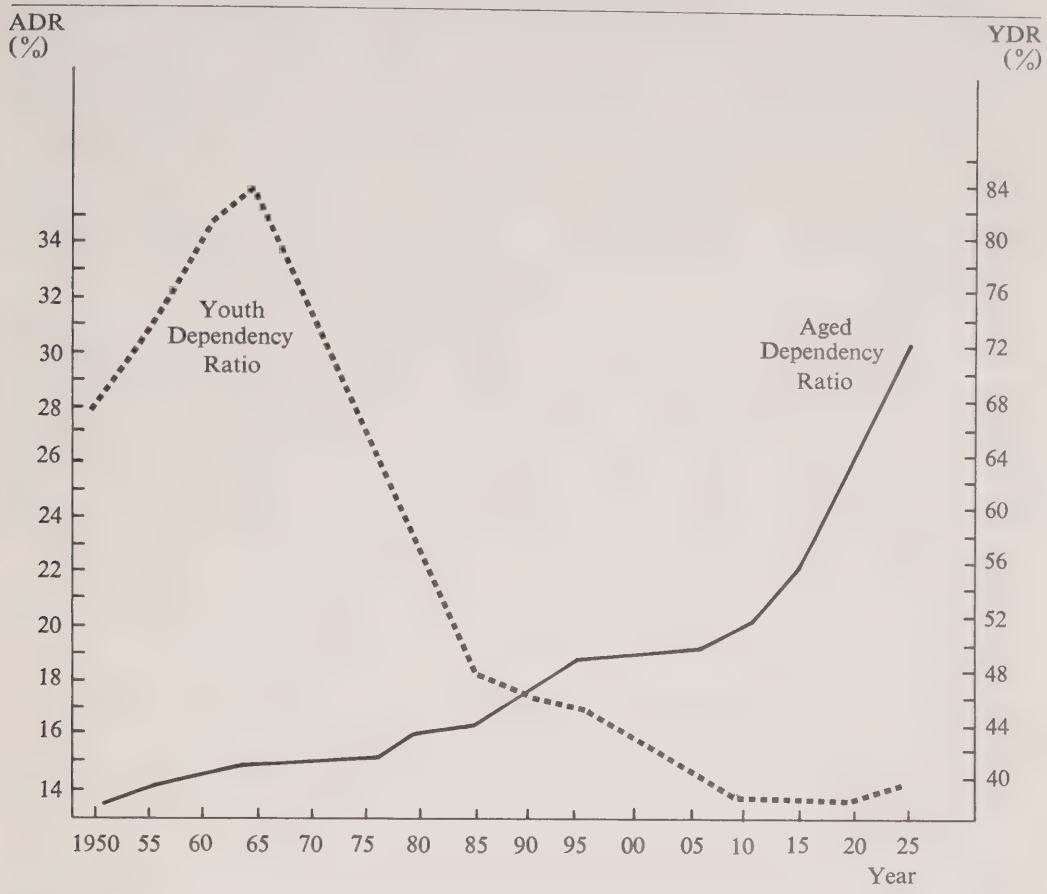
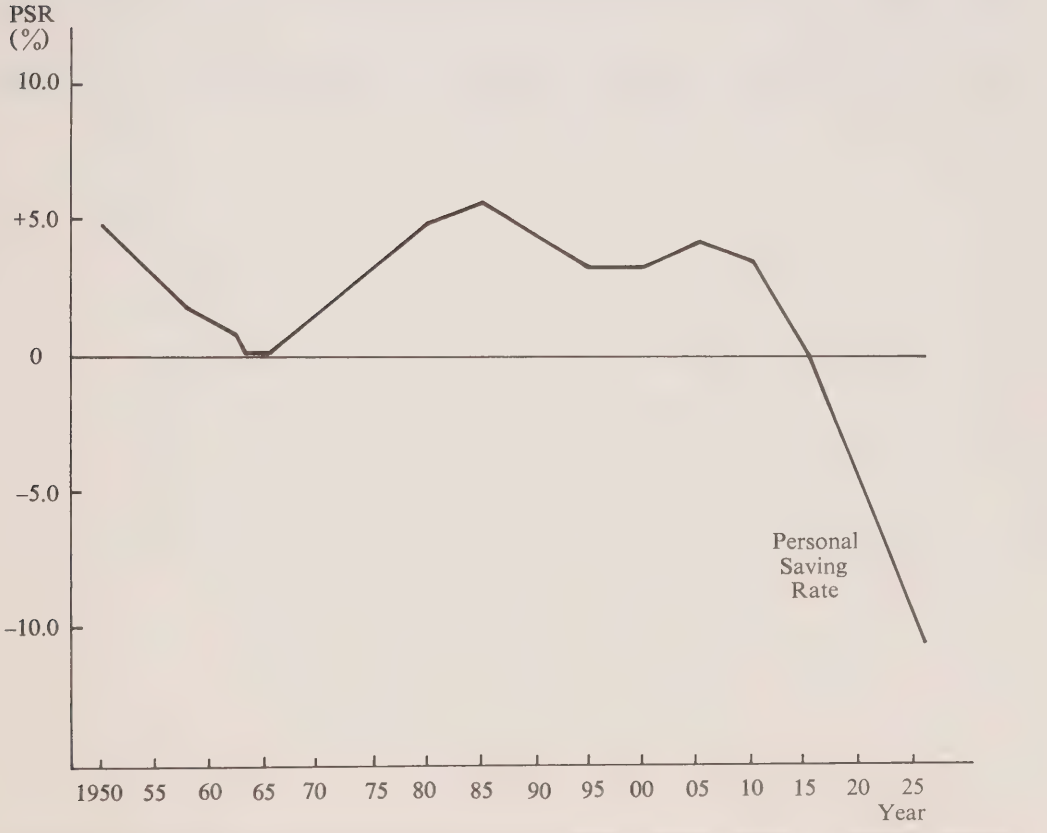
[18] Using a Life Cycle Model, Heer, N., "Demographic Effects and the Multiperiod Consumption Function", *Journal of Political Economy*, Vol. 80, 1972, reveals consumption to be sensitive to demography. In contrast, Denton, F. and B. Spencer, "Household and Population Effects on Aggregate Consumption", *Review of Economics and Statistics*, Vol. 58, 1976, employ a non-life cycle model of saving and find saving rates to be insensitive to demographic shifts.

[19] Youth dependency rate measures the number of individuals aged 0–19 as a percentage of individuals aged 20–64. Aged dependency rate is the number of individuals aged 65-plus as a percentage of individuals aged 20–64. Parameters used to calculate the impact ADR and YDR have on personal saving rate came from "Public Pensions and Personal Saving: Canadian Evidence in the Extended Life Cycle Model" (Toronto: Taxation and Fiscal Policy Branch, Ministry of Treasury, Economics and Intergovernmental Affairs, 1978).

Impact of Demographic Shifts on Personal Saving, 1950-2025

Figure 2





3. A Long Adjustment Period

Many social and economic adjustments will have to be made as the population ages. But as the various projections indicate, the period available for adjustments is lengthy. Even if the fertility rate remains at a low 1.8, the demographic shift will be gradual during the first 40 years and a marked increase in the percentage of aged will not occur until after 2010. The normalized dependency rates presented in Table 4 also illustrate the long period available for adjustment. With real per capita dependency costs growing at the same rate as real per capita income, total effective dependency will not rise appreciably above the 1976 norm until after 2011 – a full three decades into the future. Higher fertility rates will make projected demographic shifts less pronounced and, as a consequence, the necessary social and economic adjustments less of a problem.

The accommodation of an older population will also be assisted by concurrent social, economic and technological developments. A most important and probably least understood economic development compensating for the problems generated by the decline in fertility is the increasing amount of "human capital" bequeathed to children by parents. With fewer children per household there are greater education and health expenditures per child. This growing investment in human capital results in lower mortality and morbidity and, by implication, may increase productivity during the economically active years. Additional productivity will in turn raise income in the subsequent generation. The end result could be more output per capita which in turn would mitigate the economic problems generated by population ageing.[20]

An additional economic development that will ease the transition to an aged population is increases in real income levels. A 2.0 per cent annual average increase in real per capita income (well within Canada's post-war experience of 2.5 per cent per annum) will almost double income levels by 2010. Even with modest growth of 1.5 or 1.0 per cent, per capita income in 2010 would exceed 1976 levels by 66 and 42 per cent respectively. With these levels of real income, future working-age populations may likely find their relatively high dependency rates accompanied by historically high levels of discretionary income.

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[20]Nerlove, M., "Household and Economy: Toward a New Theory of Population and Economic Growth", *Journal of Political Economy*, Vol. 82, 1974.

Conclusion

While the ageing of the population will necessitate economic and institutional changes in the future, the changes will not be significant before the year 2010. Even then the system would have undergone substantial modification to allow it to accommodate these changes. Before the post-war baby boom enters the 65-plus age category, its members will have made significant contributions to Canada's social, economic and technological development.

However, it is important that present and future policies of the government be designed to flow with the natural adjustment forces. Of particular importance is the need to ensure the smooth and efficient reallocation of resources between young and aged dependents. As the population ages, especially in the years subsequent to 2010, it is hoped that the foresight gained will minimize accompanying economic costs.

Appendix

Canada Vital Statistics, 1921 – 1974 — Table 1

Year	Population (000)	Births (000)	Births per 1,000 Population	Deaths per 1,000 Population	Rate of Natural Increase
1921	9,051	264.9	29.3	11.6	17.7
1922	9,181	259.8	28.3	11.6	16.7
1923	9,267	247.4	26.7	11.8	14.9
1924	9,405	251.4	26.7	10.9	15.8
1925	9,559	249.4	26.1	10.7	15.4
1926	9,717	240.0	24.7	11.4	13.3
1927	9,904	241.1	24.3	11.0	13.3
1928	10,103	243.6	24.1	11.2	12.9
1929	10,300	242.2	23.5	11.4	12.1
1930	10,484	250.3	23.9	10.8	13.1
1931	10,658	247.2	23.2	10.2	13.0
1932	10,794	242.7	22.5	10.0	12.5
1933	10,919	229.8	21.0	9.7	11.3
1934	11,029	228.3	20.7	9.5	11.2
1935	11,135	228.4	20.5	9.9	10.6
1936	11,242	228.0	20.3	9.9	10.4
1937	11,339	227.9	20.1	10.4	9.7
1938	11,448	237.1	20.7	9.7	11.0
1939	11,565	238.0	20.6	9.7	10.9
1940	11,682	252.6	21.6	9.8	11.8
1941	11,810	264.0	22.4	10.1	12.3
1942	11,962	281.6	23.5	9.8	13.7
1943	12,108	292.9	24.2	10.1	14.1
1944	12,262	294.0	24.0	9.8	14.2
1945	12,394	300.6	24.3	9.5	14.8
1946	12,622	343.5	27.2	9.4	17.8
1947	12,888	372.6	28.9	9.4	19.5
1948	13,167	359.9	27.3	9.3	18.0
1949	13,447	367.1	27.3	9.3	18.0
1950	13,712	372.0	27.1	9.1	18.0
1951	14,009	381.1	27.2	9.0	18.2
1952	14,459	403.6	27.9	8.7	19.2
1953	14,845	417.9	28.1	8.6	19.5
1954	15,287	436.2	28.5	8.2	20.3
1955	15,698	442.9	28.2	8.2	20.0
1956	16,081	450.7	28.0	8.2	19.8
1957	16,610	469.1	28.2	8.2	20.0
1958	17,080	470.1	27.5	7.9	19.6
1959	17,483	479.3	27.4	8.0	19.4
1960	17,870	478.6	26.8	7.8	19.0
1961	18,238	475.7	26.1	7.7	18.4
1962	18,583	469.7	25.3	7.7	17.6
1963	18,931	465.8	24.6	7.8	16.8
1964	19,291	452.9	23.5	7.6	15.9
1965	19,644	418.6	21.3	7.6	13.7
1966	20,015	387.7	19.4	7.5	11.9
1967	20,378	370.9	18.2	7.4	10.8
1968	20,701	364.3	17.6	7.4	10.2
1969	21,001	369.6	17.6	7.4	10.3
1970	21,259	372.0	17.5	7.3	10.1
1971	21,569	362.2	16.8	7.3	9.5
1972	21,821	347.3	15.9	7.4	8.5
1973	22,095	343.4	15.5	7.4	8.1
1974	22,446	345.6	15.4	7.4	8.0

Source: Statistics Canada

Population Distribution by Age Groups, 1921 – 1975

Table 2

Year	Population 0–14 (000)	% of Total	Population 15–64 (000)	% of Total	Population 65+ (000)	% of Total	65+ as % of 15–64
1921	3,023.5	34.40	5,344.3	60.82	420.0	4.78	7.85
1922	3,048.2	34.20	5,438.9	60.98	431.9	4.84	7.94
1923	3,060.1	33.96	5,508.4	61.14	441.5	4.90	8.02
1924	3,085.1	33.74	5,603.0	61.28	454.9	4.98	8.12
1925	3,112.6	33.49	5,711.4	61.45	470.0	5.06	8.23
1926	3,146.3	33.29	5,818.0	61.56	486.7	5.15	8.37
1927	3,172.2	32.92	5,961.8	61.86	503.0	5.22	8.44
1928	3,199.9	32.54	6,113.9	62.16	521.2	5.30	8.52
1929	3,229.2	32.20	6,259.7	62.42	540.1	5.39	8.63
1930	3,256.8	31.90	6,393.6	62.63	557.6	5.46	8.72
1931	3,281.8	31.63	6,520.8	62.84	574.1	5.53	8.80
1932	3,285.1	31.26	6,634.3	63.12	590.6	5.62	8.90
1933	3,292.4	30.96	6,733.4	63.33	607.2	5.71	9.02
1934	3,282.9	30.56	6,830.6	63.59	627.5	5.84	9.19
1935	3,270.9	30.16	6,925.0	63.85	649.1	5.99	9.37
1936	3,242.1	29.61	7,038.9	64.28	669.0	6.11	9.50
1937	3,219.8	29.15	7,137.9	64.63	687.3	6.22	9.63
1938	3,196.2	28.66	7,250.6	65.02	705.2	6.32	9.73
1939	3,186.1	28.28	7,358.0	65.31	722.9	6.42	9.82
1940	3,079.5	27.06	7,556.7	66.40	744.8	6.54	9.86
1941	3,098.4	26.93	7,640.3	66.40	768.0	6.68	10.05
1942	3,219.4	27.62	7,644.7	65.60	789.9	6.78	10.33
1943	3,251.5	27.57	7,731.5	65.55	812.0	6.88	10.50
1944	3,291.8	27.56	7,819.4	65.46	834.8	6.99	10.68
1945	3,335.1	27.63	7,883.0	65.30	853.9	7.07	10.83
1946	3,420.4	27.83	7,992.3	65.02	879.3	7.15	11.00
1947	3,538.4	28.19	8,095.1	64.50	917.5	7.31	11.33
1948	3,678.3	28.69	8,186.8	63.84	957.9	7.47	11.70
1949	3,938.1	29.29	8,492.7	63.16	1,016.2	7.56	11.97
1950	4,070.5	29.69	8,590.2	62.65	1,051.3	7.67	12.24
1951	4,250.6	30.34	8,672.5	61.90	1,086.4	7.75	12.53
1952	4,453.0	30.80	8,886.0	61.46	1,120.0	7.75	12.60
1953	4,628.1	31.18	9,065.7	61.07	1,151.2	7.75	12.70
1954	4,834.7	31.63	9,267.4	60.62	1,184.9	7.75	12.79
1955	5,038.9	32.10	9,444.4	60.16	1,214.7	7.74	12.86
1956	5,225.3	32.49	9,614.6	59.79	1,240.9	7.72	12.91
1957	5,456.6	32.85	9,883.2	59.50	1,270.2	7.65	12.85
1958	5,712.2	34.44	10,072.8	58.97	1,295.0	7.58	12.86
1959	5,857.7	33.51	10,296.5	58.89	1,328.8	7.60	12.91
1960	6,030.0	33.74	10,482.2	58.66	1,357.8	7.60	12.95
1961	6,191.9	33.95	10,655.2	58.42	1,391.2	7.63	13.06
1962	6,309.7	33.95	10,854.3	58.41	1,419.0	7.64	13.07
1963	6,417.9	33.90	11,065.1	58.45	1,448.0	7.65	13.09
1964	6,499.3	33.69	11,314.6	58.64	1,477.1	7.66	13.05
1965	6,556.3	33.38	11,581.0	58.95	1,506.7	7.67	13.00
1966	6,591.7	32.93	11,883.6	59.37	1,539.6	7.69	12.96
1967	6,586.9	32.32	12,216.1	59.95	1,575.0	7.73	12.89
1968	6,558.0	31.68	12,532.3	60.54	1,610.7	7.78	12.85
1969	6,511.5	31.01	12,837.0	61.13	1,652.5	7.87	12.87
1970	6,453.7	30.30	13,147.6	61.73	1,695.7	7.96	12.90
1971	6,380.9	29.58	13,442.9	62.33	1,744.5	8.07	12.98
1972	6,283.2	28.79	13,749.6	63.01	1,787.7	8.19	13.00
1973	6,185.7	28.00	14,074.8	63.70	1,834.2	8.30	13.03
1974	6,097.3	27.16	14,465.9	64.45	1,883.0	8.39	13.02
1975	5,923.6	26.29	14,686.7	65.18	1,923.1	8.53	13.09

Source: Statistics Canada

Low Fertility Population Projection, 1976-2025: Fertility Rate 1.8, Net Immigration 60,000

Table 3

Year	Total Population (000)	Pop'n 0–14 (000)	% of Total	Pop'n 15–64 (000)	% of Total	Pop'n 65+ (000)	% of Total	65+ as % of 15–64
1976	22,766.8	5,801.1	25.49	14,991.2	65.84	1,974.5	8.67	13.17
1977	23,012.7	5,693.5	24.74	15,289.2	66.44	2,030.0	8.82	13.28
1978	23,260.2	5,595.7	24.06	15,575.2	66.96	2,089.3	8.98	13.41
1979	23,514.0	5,512.7	23.44	15,850.3	67.41	2,151.0	9.15	13.57
1980	23,772.8	5,447.5	22.92	16,113.3	67.78	2,212.0	9.30	13.73
1981	24,036.2	5,403.1	22.48	16,361.5	68.07	2,271.6	9.45	13.88
1982	24,303.7	5,408.6	22.25	16,565.9	68.16	2,329.2	9.58	14.06
1983	24,573.7	5,445.5	22.16	16,743.0	68.13	2,385.2	9.71	14.25
1984	24,844.1	5,489.9	22.10	16,913.4	68.08	2,440.8	9.82	14.43
1985	25,112.1	5,527.7	22.01	17,084.8	68.03	2,499.6	9.95	14.63
1986	25,375.9	5,569.4	21.95	17,242.4	67.90	2,564.1	10.10	14.87
1987	25,634.0	5,618.3	21.92	17,382.9	67.80	2,632.8	10.27	15.14
1988	25,884.4	5,670.7	21.91	17,508.4	67.64	2,705.3	10.45	15.45
1989	27,126.4	5,721.2	21.90	17,627.1	67.47	3,778.1	10.63	15.78
1990	26,359.4	5,764.8	21.87	17,746.1	67.30	2,848.5	10.81	16.05
1991	26,582.9	5,798.4	21.81	17,871.0	67.23	2,913.5	10.96	16.30
1992	26,616.7	5,820.3	21.72	18,002.4	67.18	2,794.0	11.10	16.52
1993	27,000.8	5,829.5	21.59	18,141.7	67.19	3,029.6	11.22	16.70
1994	27,195.7	5,825.9	21.42	18,289.2	67.25	3,080.6	11.33	16.84
1995	27,381.9	5,810.1	21.22	18,444.3	67.36	3,127.5	11.42	16.96
1996	27,560.2	5,783.4	20.98	18,606.2	67.51	3,170.6	11.50	17.04
1997	27,731.2	5,747.1	20.72	18,773.9	67.70	3,210.2	11.58	17.10
1998	27,895.9	5,704.0	20.45	18,944.9	67.91	3,247.0	11.64	17.14
1999	28,055.1	5,656.0	20.16	19,118.4	68.15	3,280.7	11.69	17.16
2000	28,189.6	5,606.9	19.88	19,271.7	68.39	3,311.0	11.74	17.18
2001	28,360.0	5,559.7	19.60	19,462.6	68.63	3,337.7	11.78	17.15
2002	28,516.4	5,512.9	19.33	19,637.4	68.86	3,366.1	11.80	17.00
2003	28,660.0	5,473.2	18.96	19,798.6	68.60	3,388.2	11.74	17.11
2004	28,800.5	5,438.7	18.88	19,950.6	69.27	3,411.2	11.84	17.10
2005	28,938.1	5,410.4	18.70	20,088.2	69.42	3,439.5	11.89	17.12
2006	29,072.6	5,388.4	18.53	20,208.0	69.51	3,476.2	11.96	17.20
2007	29,204.1	5,373.0	18.40	20,309.8	69.54	3,521.3	12.06	17.34
2008	29,332.2	5,363.8	18.29	20,392.8	69.52	3,575.6	12.19	17.53
2009	29,456.7	5,359.8	18.20	20,457.6	69.45	3,639.3	12.35	17.79
2010	29,577.2	5,360.5	18.12	20,504.5	69.33	3,712.2	12.55	18.10
2011	29,693.2	5,364.7	18.07	20,532.9	69.15	3,795.6	12.78	18.49
2012	29,804.2	5,371.1	18.02	20,548.8	68.95	3,884.3	13.03	18.90
2013	29,909.8	5,378.6	17.98	20,547.1	68.70	3,984.1	13.32	19.39
2014	30,009.7	5,386.4	17.94	20,530.6	68.41	4,092.7	13.64	19.93
2015	30,103.4	5,392.8	17.91	20,502.6	68.11	4,208.0	13.98	20.52
2016	30,190.8	5.397.3	17.88	20,464.8	67.78	4,328.7	14.34	21.15
2017	30,271.7	5,399.1	17.84	20,418.8	67.45	4,453.8	14.71	21.81
2018	30,346.0	5,397.9	17.79	20,367.0	67.12	4,581.1	15.10	22.49
2019	30,413.7	5,393.5	17.73	20,309.0	66.78	4,711.2	15.46	23.27
2020	30,474.6	5,385.8	17.67	20,243.0	66.43	4,845.8	15.90	23.94
2021	30,528.8	5,375.0	17.61	20,169.3	66.07	4,984.5	16.33	24.71
2022	30,576.2	5,361.9	17.54	20,089.0	65.71	5,125.3	16.76	25.51
2023	30,616.9	5,346.2	17.46	20,004.2	65.34	5,266.5	17.20	26.33
2024	30,650.9	5,329.0	17.39	19,916.0	64.98	5,405.9	17.64	27.14
2025	30,678.3	5,310.6	17.31	19,826.7	64.63	5,541.0	18.06	27.95

Source: Statistics Canada

Medium Fertility Population Projection, 1976-2025: Fertility Rate 2.2, Net Immigration 60,000

Table 4

Year	Total Population (000)	Pop'n 0–14 (000)	% of Total	Pop'n 15–64 (000)	% of Total	Pop'n 65+ (000)	% of Total	65+ as % of 15–64
1976	22,846.3	5,878.8	25.73	14,992.5	65.62	1,975.0	8.64	13.17
1977	23,141.6	5,820.8	25.15	15,290.1	66.07	2,030.7	8.78	13.28
1978	23,456.0	5,788.4	24.68	15,577.6	66.41	2,090.0	8.91	13.42
1979	23,784.4	5,780.0	24.30	15,852.6	66.65	2,151.8	9.05	13.57
1980	24,124.0	5,795.2	24.02	16,116.0	66.80	2,212.8	9.17	13.73
1981	24,472.5	5,835.4	23.84	16,364.8	66.87	2,272.3	9.29	13.89
1982	24,827.4	5,928.0	23.88	16,606.4	66.88	2,293.0	9.24	13.81
1983	25,186.7	6,053.7	24.04	16,746.6	66.49	2,386.4	9.47	14.25
1984	25,547.0	6,187.7	24.22	16,917.1	66.22	2,442.2	9.56	14.44
1985	25,905.2	6,315.1	24.38	17,088.7	65.97	2,501.4	9.66	14.64
1986	26,258.7	6,446.3	25.55	17,246.7	65.68	2,565.7	9.77	14.88
1987	26,605.8	6,583.8	24.75	17,387.5	65.35	2,634.5	9.90	15.15
1988	26,944.5	6,719.4	24.94	17,518.2	65.02	2,706.9	10.05	15.45
1989	27,273.9	6,845.0	25.10	17,648.7	64.71	2,780.2	10.19	15.75
1990	27,593.2	6,952.5	25.20	17,789.9	64.47	2,850.8	10.33	16.02
1991	27,902.1	7,035.6	25.22	17,950.5	64.33	2,916.0	10.45	16.24
1992	28,200.8	7,090.3	25.14	18,131.0	64.29	2,979.5	10.57	16.43
1993	28,490.1	7,118.9	24.98	18,338.9	64.37	3,032.3	10.64	16.53
1994	28,771.5	7,127.3	24.77	18,560.8	64.51	3,083.4	10.72	16.61
1995	29,046.5	7,119.9	24.51	18,796.3	64.71	3,130.3	10.78	16.65
1996	29,317.0	7,101.4	24.22	19,042.0	64.95	3,173.6	10.83	16.67
1997	29,584.8	7,075.1	23.91	19,296.1	65.22	3,213.6	10.86	16.66
1998	29,851.3	7,045.1	23.60	19,555.7	65.51	3,250.5	10.89	16.62
1999	30,117.9	7,015.6	23.29	19,818.0	65.80	3,284.3	10.90	16.57
2000	30,385.7	6,991.0	23.01	20,079.9	66.08	3,314.8	10.91	16.51
2001	30,655.5	6,974.4	22.75	20,339.3	66.35	3,341.8	10.90	16.43
2002	30,927.6	6,967.9	22.53	20,593.6	66.59	3,366.1	10.88	16.35
2003	31,202.4	6,972.4	22.54	20,841.8	67.39	3,388.2	10.96	16.26
2004	31,479.5	6,988.8	22.20	21,079.5	66.96	3,411.2	10.84	16.18
2005	31,758.9	7,017.4	22.10	21,302.0	67.07	3,439.5	10.83	16.15
2006	32,039.8	7,058.0	22.03	21,505.6	67.12	3,476.2	10.85	16.16
2007	32,321.8	7,109.5	22.00	21,691.0	67.11	3,521.3	10.89	16.23
2008	32,603.9	7,170.4	21.99	21,857.9	67.04	3,575.6	10.97	16.36
2009	32,885.5	7,238.8	22.01	22,007.4	66.92	3,639.3	11.07	16.54
2010	33,165.5	7,311.8	22.05	22,141.5	66.76	3,712.2	11.19	16.77
2011	33,443.1	7,386.8	22.09	22,262.5	66.57	3,793.8	11.34	17.04
2012	33,717.4	7,461.6	22.13	22,371.5	66.35	3,884.3	11.52	17.36
2013	33,987.7	7,533.6	22.17	22,470.0	66.11	3,984.1	11.72	17.73
2014	34,253.6	7,601.5	22.19	22,559.4	65.86	4,092.7	11.95	18.14
2015	34,514.7	7,663.7	22.20	22,643.0	65.60	4,208.0	12.19	18.58
2016	34,770.8	7,719.8	22.20	22,772.6	65.35	4,328.7	12.45	19.05
2017	35,022.0	7,768.2	22.18	22,800.0	65.10	4,453.8	12.72	19.53
2018	35,268.5	7,810.0	22.14	22,877.4	64.87	4,581.1	12.99	20.02
2019	35,510.3	7,845.5	22.09	22,953.3	64.64	4,711.5	13.27	20.53
2020	35,747.8	7,875.1	22.03	23,026.9	64.41	4,845.8	13.56	21.04
2021	35,981.4	7,900.4	21.96	23,096.5	64.19	4,984.5	13.85	21.58
2022	36,211.2	7,921.9	21.88	23,164.0	63.97	5,125.3	14.15	22.13
2023	36,437.7	7,941.4	21.79	23,229.7	63.75	5,266.6	14.45	22.67
2024	36,661.1	7,960.0	21.71	23,295.2	63.54	5,405.9	14.75	23.21
2025	36,881.6	7,978.5	21.63	23,362.1	63.34	5,541.0	15.02	23.72

Source: Statistics Canada

High Fertility Population Projection, 1976-2025: Fertility Rate 2.6, Net Immigration 100,000 — Table 5

Year	Total Population (000)	Pop'n 0–14 (000)	% of Total	Pop's 15–64 (000)	% of Total	Pop'n 65+ (000)	% of Total	65+ as % of 15–64
1976	23,086.1	5,993.9	25.96	15,113.5	65.47	1,978.7	8.57	13.09
1977	23,478.5	6,001.1	25.56	15,441.5	65.77	2,035.9	8.67	13.18
1978	23,905.7	6,049.3	25.30	15,760.1	65.93	2,096.3	8.77	13.30
1979	24,357.2	6,131.4	25.17	16,066.6	65.96	2,159.2	8.86	13.44
1980	24,827.4	6,244.1	25.15	16,361.3	65.90	2,222.0	8.95	13.58
1981	25,311.5	6,386.3	25.23	16,642.3	65.75	2,282.9	9.02	13.72
1982	25,806.0	6,583.8	25.51	16,879.4	65.41	2,342.8	9.08	13.88
1983	26,306.5	6,817.0	25.91	17,089.5	64.96	2,400.0	9.12	14.04
1984	26,810.2	7,059.2	26.33	17,293.7	64.50	2,457.3	9.17	14.21
1985	27,312.8	7,294.9	26.71	17,499.9	64.07	2,518.0	9.22	14.39
1986	27,810.9	7,534.4	27.09	17,692.1	63.62	2,584.4	9.29	14.61
1987	28,303.1	7,779.4	27.49	17,868.7	63.13	2,655.0	9.38	14.86
1988	28,786.7	8,017.5	27.85	18,040.2	62.67	2,729.0	9.48	15.13
1989	29,260.7	8,237.7	28.15	18,219.0	62.26	2,804.0	9.58	15.39
1990	29,724.3	8,427.7	28.35	18,420.2	61.97	2,876.0	9.68	15.62
1991	30,177.6	8,578.3	28.43	18,656.3	61.82	2,943.5	9.75	15.78
1992	30,621.2	8,683.6	28.36	18,931.2	61.82	3,006.4	9.82	15.88
1993	31,057.0	8,748.5	28.17	19,244.7	61.97	3,063.8	9.87	15.92
1994	31,487.6	8,786.0	27.90	19,584.5	62.20	3,117.1	9.90	15.92
1995	31,916.5	8,805.5	27.59	19,944.9	62.49	3,166.1	9.91	15.87
1996	32,347.1	8,814.7	27.25	20,320.7	62.82	3,211.7	9.93	15.81
1997	32,782.3	8,820.4	26.91	20,708.0	63.17	3,253.9	9.93	15.71
1998	33,224.6	8,828.4	26.57	21,102.7	63.52	3,293.5	9.91	15.61
1999	33,676.1	8,844.4	26.26	21,501.9	63.85	3,329.8	9.89	15.49
2000	34,138.0	8,874.0	25.99	21,900.9	64.15	3,363.1	9.85	15.36
2001	34,611.4	8,920.8	25.77	22,297.4	64.42	3,393.2	9.80	15.22
2002	35,096.4	8,987.2	25.61	22,688.4	64.65	3,420.8	9.75	15.08
2003	35,593.1	9,074.1	25.49	23,072.6	64.82	3,446.4	9.68	14.94
2004	36,100.8	9,181.6	25.43	23,446.0	64.95	3,473.2	9.62	14.81
2005	36,618.5	9,309.9	25.42	23,802.8	65.00	3,505.8	9.57	14.73
2006	37,145.1	9,457.7	25.46	24,140.3	64.99	3,547.1	9.55	14.69
2007	37,679.3	9,622.6	25.50	24,459.2	64.91	3,597.5	9.55	14.71
2008	38,219.4	9,801.7	25.65	24,670.3	64.78	3,657.4	9.57	14.77
2009	38,763.9	9,990.3	25.77	25,046.1	64.61	3,727.5	9.62	14.88
2010	39,311.2	10,183.3	25.90	25,320.3	64.41	3,807.6	9.69	15.04
2011	39,859.9	10,377.1	26.03	25,585.8	64.19	3,897.0	9.78	15.23
2012	40,408.5	10,566.5	26.15	25,845.3	63.96	3,996.7	9.89	15.46
2013	40,956.3	10,748.3	26.23	26,101.9	63.73	4,106.1	10.03	15.73
2014	41,502.7	10,920.4	26.31	26,356.6	63.51	4,225.7	10.18	16.03
2015	42,047.5	11,081.3	26.35	26,612.9	63.29	4,353.3	10.35	16.36
2016	42,590.8	11,230.1	26.37	26,873.6	63.10	4,487.1	10.54	16.70
2017	43,133.3	11,366.9	26.35	27,140.0	62.92	4,626.4	10.72	17.04
2018	43,675.4	11,493.0	26.31	27,413.7	62.77	4,768.7	10.92	17.40
2019	44,218.1	11,609.8	26.26	27,694.0	62.63	4,914.3	11.11	17.75
2020	44,762.2	11,719.2	26.18	27,979.0	62.51	5,064.0	11.31	18.10
2021	45,308.6	11,823.6	26.10	28,266.9	62.39	5,218.1	11.52	18.46
2022	45,858.2	11,925.5	26.01	28,559.1	62.28	5,373.6	11.72	18.82
2023	46,411.9	12,027.6	25.91	28,854.3	62.17	5,530.0	11.92	19.17
2024	46,970.2	12,132.4	25.83	29,154.0	62.07	5,683.6	12.10	18.47
2025	47,533.9	12,242.0	25.75	29,458.3	61.97	5,833.1	12.27	18.29

Source: Statistics Canada

The Economics of Financing National Pension Plans

Table of Contents

Introduction

Two schools of thought prevail with respect to financing national pension plans such as the Canada Pension Plan. One argues that national pension plans should be funded in the same manner as private sector pension plans. The other contends that national pension plans should be financed on a pay-as-you-go basis.

The purpose of this paper is not to promote either of the two approaches. Rather, it presents the two methods of financing in a consistent and understandable economic framework. In this way, the many interrelated economic issues involved in evaluating pay-as-you-go and full funding can be appreciated.

The paper is divided into five parts. Section I introduces the principles of economic growth. It establishes what is actually meant by economic growth, explains how economic growth is affected by the saving rate, and presents the conditions for optimal economic growth.

Section II presents the most widely accepted economic criterion by which pay-as-you-go and investment fund methods of financing can be evaluated. Using this criterion, the conditions under which each of the two financing methods is optimal are stated and discussed.

Section III reveals that principles of economic growth and national pension plan financing are intrinsically related. In particular, it is revealed that the optimality conditions established for choosing between pay-as-you-go financing and investment fund financing are identical to the economic conditions used to determine optimal economic growth.

With the interrelationship between economic growth and the financing of national pension plans as background, two additional issues which affect the choice of financing methods are examined. Section IV shows that pay-as-you-go contribution rates are sensitive to demographic changes while investment fund contribution rates are not. This is significant since Canada is in the initial stages of demographic ageing. The second issue is the possible negative impact of pay-as-you-go financing on saving. This is examined in Section V.

The paper concludes by summarizing the principal issues and discussing three important caveats relating to the implementation of investment funded national pension plans.

I. Principles of Economic Growth[1]

Economic growth and the financing of national pensions are intrinsically related. A full understanding of the issues surrounding national pension plan financing cannot be obtained without an understanding of the basic principles of economic growth.

1. A Simple Model of Economic Growth

Models of economic growth provide a description of the **long run** relationships among fundamental economic variables: output, capital, labour, profits, wages, consumption, saving, investment and technological progress. The long run implies that **the level of capital stock is variable.** In short run economic analysis, the level of capital stock is assumed to be invariant.

The economist hopes that the analysis of theoretical growth models, which are based on simple assumptions, will yield useful insights into the process of economic growth. Assumptions underlying simple growth models include:

- There are two basic factors of production: capital and labour.
- In the production process, capital and labour are substitutable.
- Labour input grows at a given rate.
- Capital and labour markets are perfectly competitive.
- There are diminishing returns to scale; that is, holding one factor of production constant, the continued addition of the other factor leads to progressively smaller additions of output.
- Output per unit of labour grows over time due to technological progress.
- The economy is closed: no exports or imports.
- Saving/investment, the process of increasing the capital stock, occurs at a given rate; that is, a proportion of output is not consumed but used to add to the economy's stock of capital.

Although some of the assumptions may seem unreasonable, economists argue that they are valid over the long run. Further, it is argued that the introduction of more realistic assumptions does not change the basic conclusions; it only complicates the analysis.

Of the above assumptions, one is of particular interest with respect to the economics of financing national pension plans:

- Saving/investment, the process of adding to the capital stock, occurs at a given rate.

2. Further Description of Economic Growth

An economy in which total output is growing at a steady rate is said to be on a **long run growth path.** Such a growth path is illustrated in Figure 1(a). Output grows at an annual rate equal to the sum of the growth rates of labour (g) and technological progress (p). Growth rates can be expressed as percentages.

Another, and probably a more important, view of economic growth is the long run growth of **output per unit of labour.** This growth path measures the impact of technological change on output produced per unit of labour employed. As Figure 1(b) illustrates, output per unit of labour does not increase as quickly as total output. This is because the former is growing only by the rate of technological progress.

To make a clearer pictorial representation of a growing economy, the exponential functions in Figure 1 are transformed to their natural log forms. This allows the non-linear growth paths to be viewed as straight lines. The long run growth path of output presented in Figure 1(a) is equivalently portrayed in Figure 2(a).

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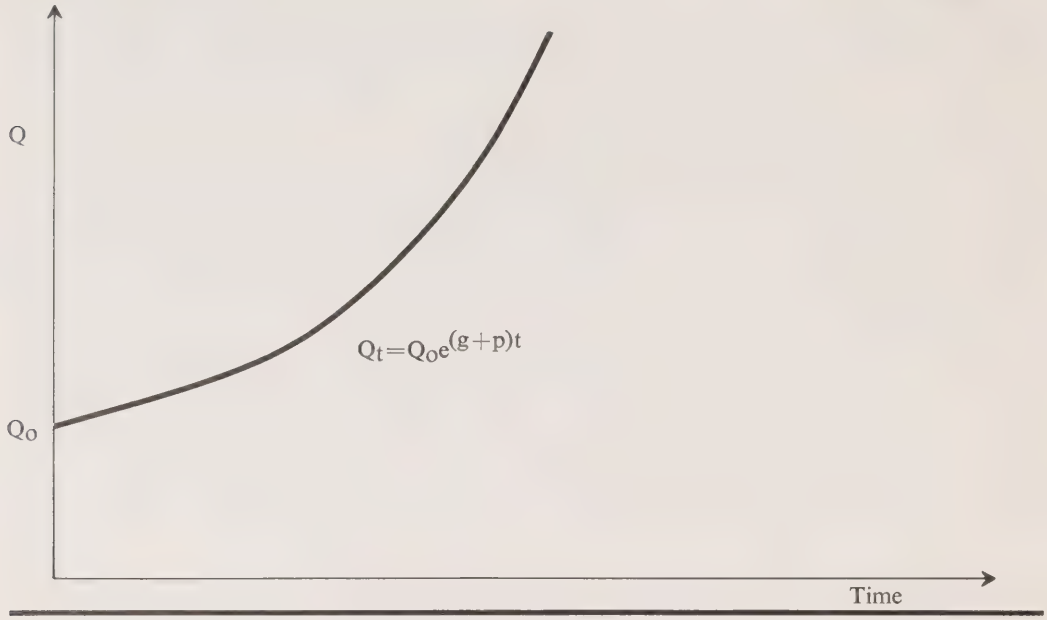
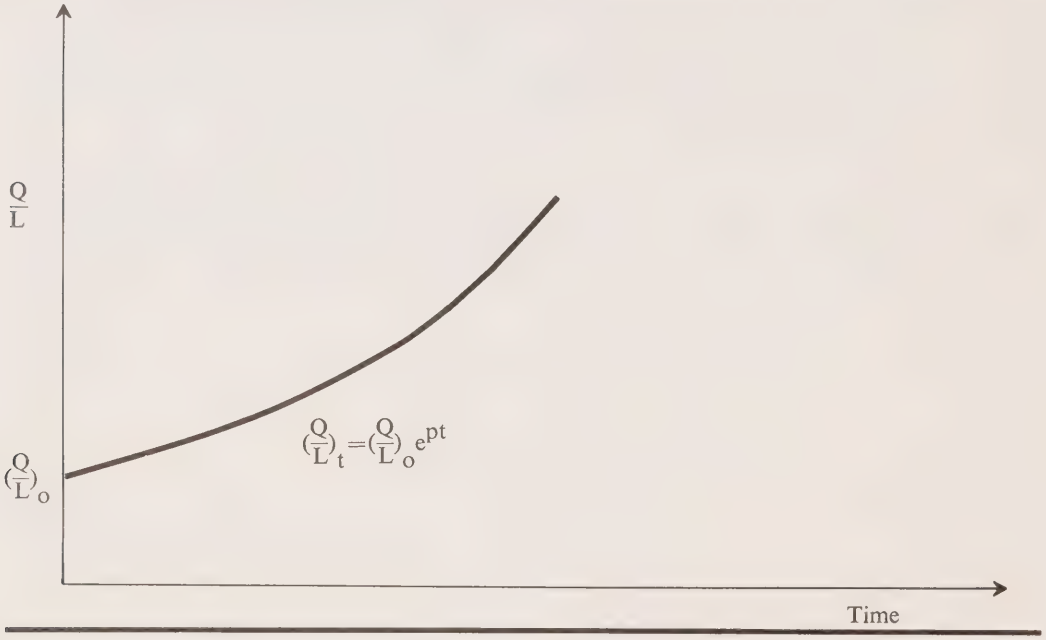
[1]A more detailed introduction to the principles of economic growth can be obtained from an intermediate textbook on macroeconomic theory. For example, see Branson, W. H., *Macroeconomic Theory and Policy* (New York: Harper and Row, 1972) or Beare, J. B., *Macroeconomics: Cycles, Growth and Policy in a Monetary Economy* (New York: Macmillan, 1978).

Long Run Growth Path of Output — Figure 1(a)



Long Run Growth Path of Output Per Unit of Labour — Figure 1(b)

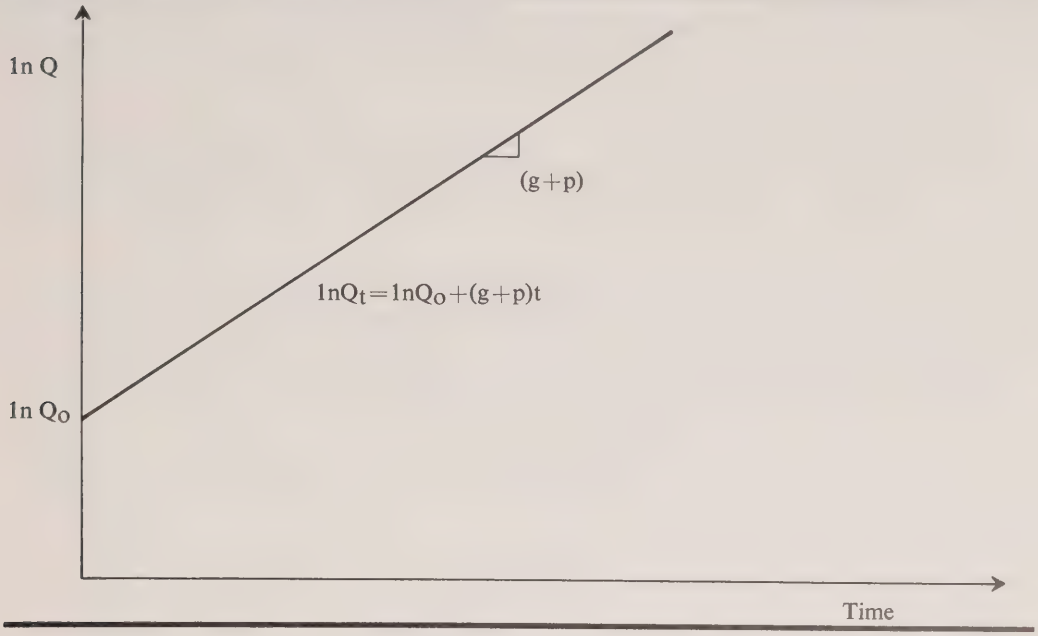


Accepting that the objective of "economic man" is to consume, it is important to understand that there is also a growth path of consumption per unit of labour. Figure 2(b) illustrates the growth paths of output and consumption per unit of labour. As the diagram indicates, consumption per unit of labour grows at the same rate as output per unit of labour. Historically, Canada's annual rate of technological advance has been about 2.4 per cent.[2]

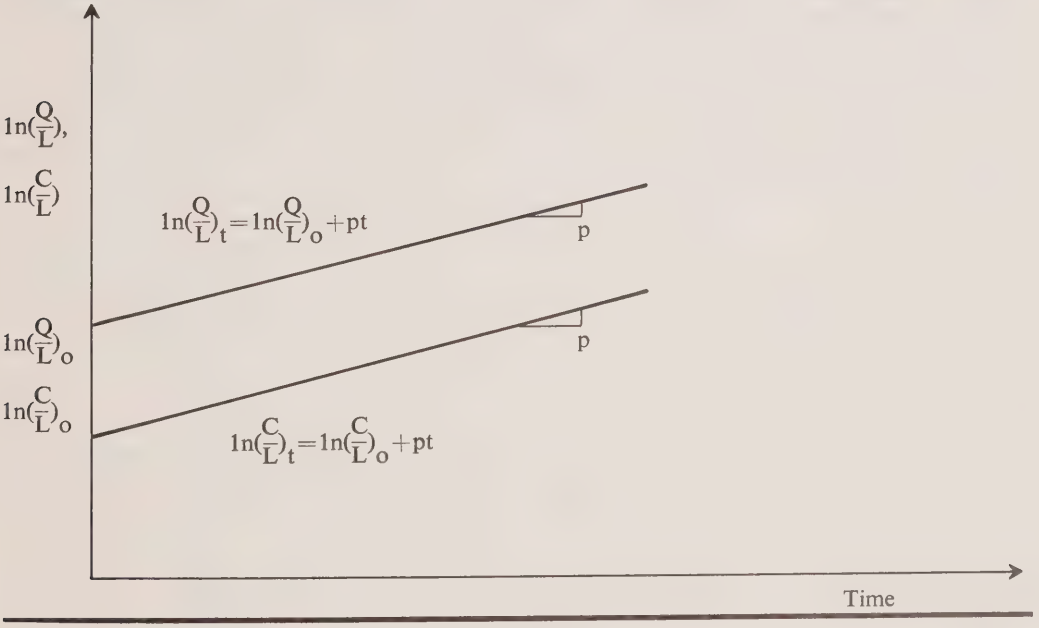
Finally, output and consumption per unit of labour may be interpreted as output and consumption per capita.

[2]Lithwick, N. H., *Economic Growth in Canada: A Quantitative Analysis* (Toronto: University of Toronto Press, 1967).

Long Run Growth Path of Output — Figure 2(a)



Long Run Growth Path of Output and Consumption per Unit of Labour — Figure 2(b)



3. Principles of Economic Growth (I)

An analysis of economic growth models yields a number of principles which are related to the selection of the optimal method of financing a national pension plan:

(i) Once an economy is on a particular growth path, the long run rate of growth of output equals the sum of the growth rates of labour and technological progress.

(ii) A change in the saving/investment rate **does not** affect the economy's **long run growth rate**, it only affects the **level** of the growth path.

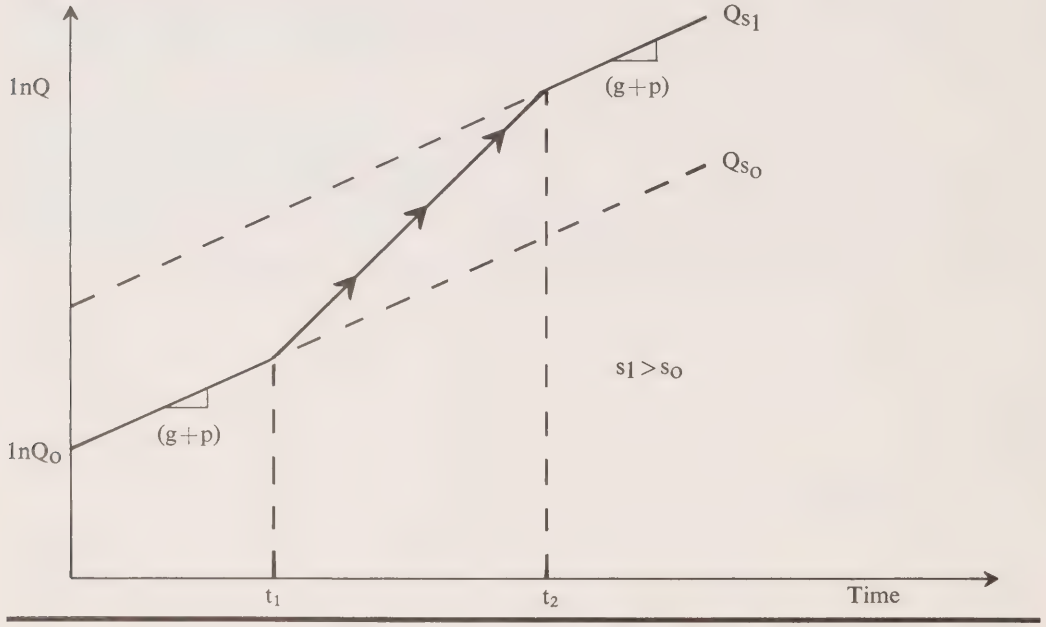
(iii) Similarly, a change in the saving/investment rate does not affect the long run growth rates of output or consumption per unit of labour; only the **level** of their growth paths.

From this paper's perspective, the most significant principle of economic growth is:

(iv) A higher saving/investment rate moves an economy to a higher growth path. Conversely, a lower saving/investment rate moves an economy to a lower growth path.

Figures 3(a) and 3(b) illustrate these four principles. An increase in the saving rate will shift the economy to a higher growth path with the same long run growth rate. Only during the transition period when the economy moves between growth paths are the growth rates of output, output per unit of labour and consumption per unit of labour different from their corresponding long run rates of growth.

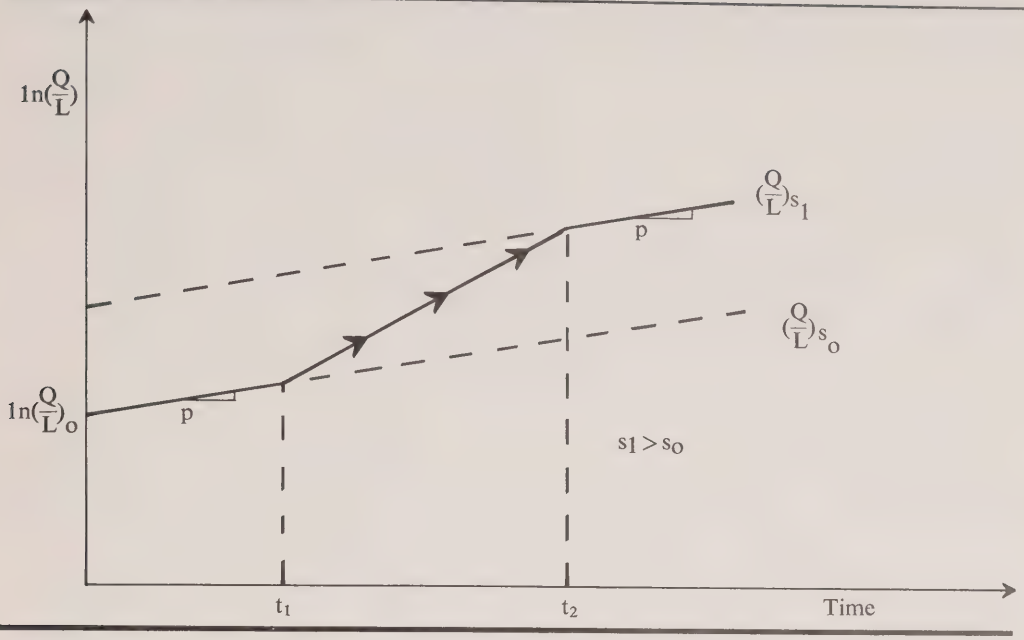
Shift in Growth Path of Output Due to Saving Rate Change — Figure 3(a)



An explanation of how an increased saving rate moves an economy to a higher growth path is as follows. An increase in saving, which is at the cost of current consumption, adds to the capital stock and initially raises the growth rate of capital relative to the growth rate of labour. This ensures that during the transition period there is an increase in the amount of capital per unit of labour. But as the capital stock increases relative to labour, an ever increasing proportion of the higher rate of saving/investment must be used to maintain the increasing stock of capital. This lowers the growth rate of capital. The increase in capital per unit of labour will cease when the new rate of saving/investment is just sufficient to support the larger capital stock. The economy is now on a higher growth path with a larger capital stock and increased output per unit of labour.

The vertical distances between the growth paths in Figures 3(a) and 3(b) measure the increase in output and output per unit of labour because of the increase in the stock of capital relative to labour. As a percentage difference, the vertical distances between the paths portrayed in the two figures remain constant over time. But the absolute value of the differences increases at the rate of growth of output (g+p) and output per unit of labour (p) respectively.

Shift in Growth Path of Output Per Unit of Labour Due to Saving Rate Change — Figure 3(b)



4. Principles of Economic Growth (II)

The previous section noted that a change in the saving rate places the economy on a higher growth path with respect to total output and output per unit of labour. This seems to suggest that the higher the saving rate the better, because the resulting move to a higher growth path means more output per unit of labour.

This is not the case. The economic objective is not to maximize the level of output per unit of labour but to maximize the level of consumption per unit of labour.

Since saving means that a portion of income cannot be consumed, the pursuit of higher growth paths through higher saving rates must eventually mean lower levels of consumption per unit of labour. In light of this, the economic problem becomes one of determining which saving rate puts an economy on the highest growth path of consumption per unit of labour. The objective, therefore, is not to maximize the saving rate, but to find the optimal rate of saving. Specifically, the optimal saving rate generates:

> a higher level of per capita consumption than any other growth path for all time. Once attained, this growth path would be preferred by members of all generations.

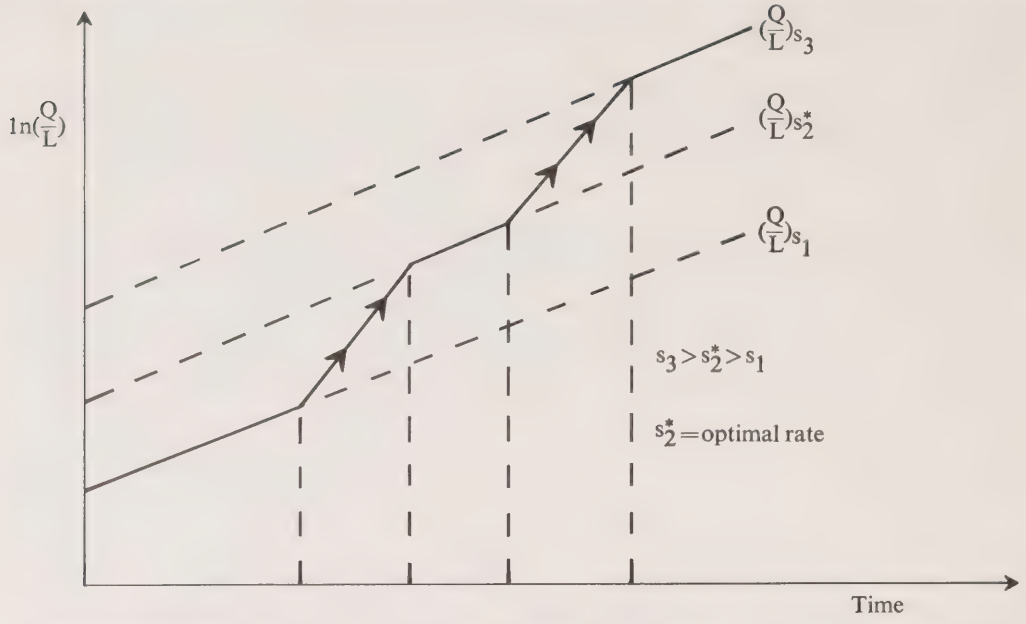
Analyzing growth models with the objective of maximizing per capita consumption yields the following principles:

(v) The highest growth path of consumption per unit of labour is attained when the profit rate (the rate of return to capital) equals the long run rate of growth of output.

(vi) The optimal rate of saving is the rate which maintains the ratio of the stock of capital to labour such that the rate of return on capital (r_K) equals the rate of growth of output ($g+p$).

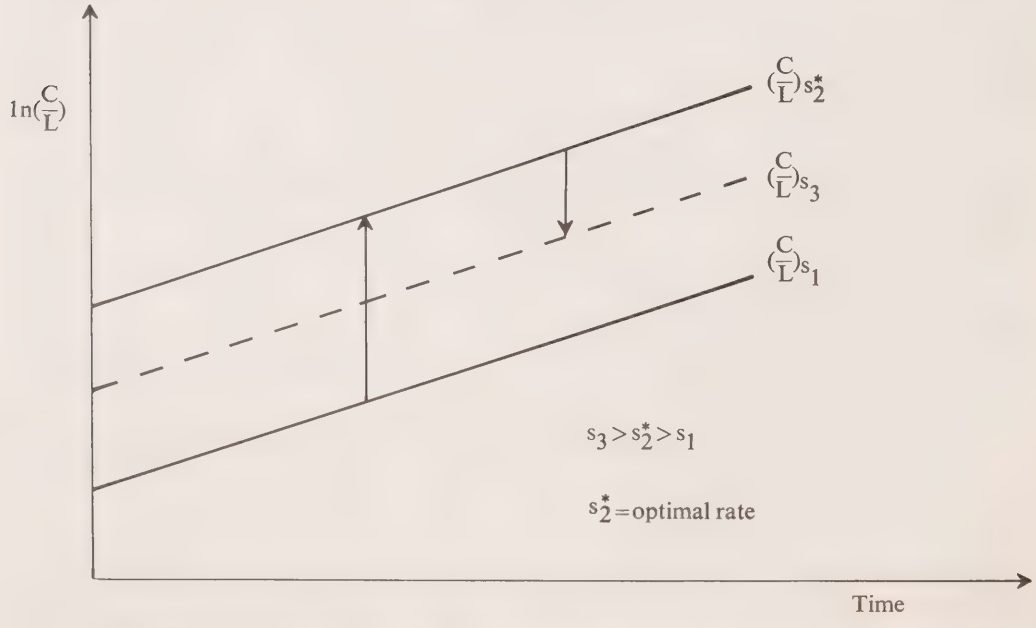
A comparison of Figures 4(a) and 4(b) illustrates the impact of a steadily increasing saving rate. A higher rate of saving continually raises the long run growth path of output per unit of labour, but raising the saving rate beyond its optimal rate (s_2^*) actually lowers the long run growth path of consumption per unit of labour.

Effect on Output Per Capita Growth Path of Raising Saving Rate Above the Optimal Rate — Figure 4(a)



An increase in the saving rate increases per capita consumption as long as the additional output resulting from the increased capital stock exceeds the additional investment required to sustain the higher stock of capital. The positive difference between the additional output and the needed additional investment is consumed. But as the amount of capital increases relative to labour, increases in output diminish. At saving rates above the optimal, the amount of investment/saving needed to sustain the larger capital stock exceeds the output generated by the additional capital. This larger and now sub-optimal stock of capital can only be sustained by reducing consumption. The growth path of per capita consumption is lowered.

Effect on Consumption Per Capita Growth Path of Raising Saving Rate Above the Optimal Rate — Figure 4(b)



5. The Saving Rate and Government Policy

The level of an economy's growth path is determined by its saving/investment rate. Thus in theory, if government can influence the saving rate, policies can be designed to produce the optimal saving rate and move the economy towards its optimal long run growth path.

Before implementing a designated policy, it must be ascertained if the economy's current saving rate is above, below or at the optimum. One method of finding this out is to compare the rate of return to capital with the long run growth rate of the economy.

The preceding material has revealed that an economy's saving rate is already optimal if the rate of return to capital (r_k) equals the long run growth rate of the economy ($g+p$). If the profit rate is greater than the economy's growth rate, saving is below the optimal rate. Conversely, if the rate of return to capital is less than the rate of growth of output, saving is above the optimal rate.

With these three conditions, a simple decision matrix can be constructed with respect to government policy.

Decision Matrix for Saving/Investment Policy — Table 1

	Position of the Saving Rate	Implication for Policy
If $r_k > g + p$	Saving rate is below optimal rate.	Increase the saving rate to move the economy to a higher consumption path.
If $r_k = g + p$	Saving rate is optimal.	Maintain the existing saving rate. Any other saving rate lowers the consumption path.
If $r_k < g + p$	Saving rate is above optimal rate.	Decrease the saving rate to put the economy on a higher consumption path.

6. Principles of Economic Growth (III)

The preceding sections have pointed out that there is an optimal rate of saving which will put an economy on its highest consumption growth path. It has also been revealed that it is possible to determine whether an economy's existing saving rate is sub-optimal and how that saving rate should be influenced by government policies in order to move to a higher consumption growth path.

The following principle must now be emphasized:

(vii) **There is a cost in moving to a higher growth path.** The cost is measured in the consumption that must be initially foregone to provide the extra saving/investment that is needed to build up capital and move the economy to a higher long run growth path.

Because the transition from one growth path to another may take many years, the generation(s) foregoing current consumption may not benefit substantially from the ultimately higher consumption growth path. Thus it must be recognized that policies which raise the saving rate increase the consumption of future generations at the cost of reducing the consumption of the present generation.

Although economic growth theory gives a method of ascertaining if an economy is below its highest consumption growth path, it does not give a criterion for deciding if the rate of saving should be adjusted to move the economy to its optimal long run growth path. **This is a matter of social and political values.**

But once it is decided that the economy should move towards a higher consumption growth path, economic theory yields the following principle:

(viii) The longer the planning horizon, the faster an economy should move towards the higher consumption growth path.

Expressed in another way, this principle means the more the current generation values the consumption of future generations, the more rapid should be the move to the higher consumption growth path.

II. The Optimal Financing of National Pension Plans

National pension plans can be either pay-as-you-go or investment fund financed. Economists have pointed out that benefits promised by a national pension plan need not be secured by an investment fund since the government has the power to tax those in the labour force to meet future pension obligations. Thus, in contrast to pension plans in the private sector, it cannot be argued that a national pension plan investment fund is necessary to guarantee the provision of accrued retirement benefits.

To most economists the question of whether to pay-as-you-go or investment fund finance a national pension plan is not decided on the issue of security, but on which method is optimal.

1. Selection Criterion

Before the two methods of financing can be evaluated, it is necessary to establish a selection criterion. The criterion most widely accepted was introduced by Paul Samuelson. The optimal method of financing would:

> 'give every representative man . . . a lifetime consumption profile that he would prefer over any other one available to him and to everyone else'[3].

With respect to pay-as-you-go and investment fund financing of national pension plans, the optimal method is the one which satisfies this criterion.

2. Optimality Conditions

Under a pay-as-you-go pension plan the contribution rate on earnings is established so that total contributions equal pension benefits paid in the same year. Thus the return workers receive on their contributions during their retirement years depends on taxes collected from the earnings of future workers. With the condition that the contribution rate remains constant, the rate of return on contributions under pay-as-you-go financing is equal to the growth rate of aggregate earnings (g_e).

Under a funded system, contributions are invested in capital. The rate of return on the contributions in this situation is equal to the return to capital (r_k).

Determining the optimal method of financing a national pension plan involves the comparison of the rate of return to capital (r_k) and the rate of growth of aggregate earnings (g_e). If the return to capital is greater than the growth rate of aggregate earnings, the investment fund method of financing is optimal. If the return to capital is less than or equal to the growth rate of aggregate wages, pay-as-you-go financing is optimal.

Decision Matrix for Pension Financing — Table 2

	Position of Return to Capital	Implication for Financing
If $r_k > g_e$	Return on capital exceeds growth in aggregate earnings.	Investment fund financing is optimal.
If $r_k = g_e$	Return on capital equals growth in aggregate earnings.	Pay-as-you-go financing is optimal.
If $r_k < g_e$	Return on capital is less than growth in aggregate earnings.	Pay-as-you-go financing is optimal.

The reasonableness of the optimality conditions is readily apparent. Given that contributions to a national plan must be made, then the method yielding the highest return is preferred. With a higher return more generous pension benefits can be provided. Conversely, with pension benefits predetermined, a higher return means pension contributions can be reduced. From both viewpoints, the financing method yielding the highest return is preferred.

[3]Samuelson, P. A., "Consumption-Loan, Interest and Money: A Reply", *Journal of Political Economy*, Vol. LXVII, 1959, p. 519.

The conditions of optimality can be presented in the form of a decision matrix with respect to the two financing options. The reader should note that Table 2 is not dissimilar to Table 1 presented in Section I.

3. A Conflict Between Generations?

Significantly, the above optimality conditions only apply when the national pension plan is fully mature. If the plan is phased in over a number of years under pay-as-you-go financing, the long run pay-as-you-go contribution rate does not materialize until the plan has matured. Pay-as-you-go financing would be preferred by the founding generation since they would receive full retirement pensions without having to contribute at the mature pay-as-you-go contribution rate over all of their working lives.

It is possible, therefore, that the method of financing selected by the founding generation may differ from the financing method preferred by future generations which will face the mature pay-as-you-go contribution rate. Unfortunately, if the founding generation has already selected pay-as-you-go financing, future generations must accept this method regardless of their preferences because the opportunity to build an investment fund is lost[4]. The possibility for an intergenerational conflict is clear.

The near certainty of the founding generation selecting pay-as-you-go financing is also clear. The assumption that the plan is mature, when in fact it is not, is tantamount to asking future generations the following question: if you could retroactively impose on the founding generation either a pay-as-you-go or investment fund method of financing, which would you choose? Since future generations do not have a voice, their preference may have little influence on the financing decision.

4. The "Social Insurance Paradox"[5]

The optimality conditions indicate that if the growth rate of aggregate earnings (g_e) exceeds the return to capital (r_k) then pay-as-you-go financing is optimal. This means no investment fund should be accumulated because contributions receive a higher rate of return from the growth of aggregate earnings than is available from capital investment. The high return available from the growth in aggregate earnings allows contribution rates to be lower than what would be necessary if future pensions were dependent upon an investment fund.

In other words, an unfunded pay-as-you-go plan would generate higher pension benefits than would be available from an investment funded plan. This is the social insurance paradox.

It is emphasized that **the paradox depends upon the growth rate of aggregate earnings being greater than the return to capital.** In Section III, the social insurance paradox will be interpreted from the perspective of economic growth.

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[4]An investment fund can still be implemented, but only at a contribution rate which would exceed the mature pay-as-you-go rate. It is assumed that future generations would not be willing to raise contribution rates above the mature pay-as-you-go rate.

[5]Aaron, H., "The Social Insurance Paradox", *Canadian Journal of Economics and Political Science*, Vol. XXXII, 1966, pp. 371-4.

III. Economic Growth and the Optimal Financing of National Pension Plans

It has undoubtedly been noted that there are similarities between the principles of economic growth introduced in Section I and the conditions determining the optimal method of financing national pension plans discussed in Section II. The similarities are not coincidental. The economic principles involved in choosing the optimal financing method are the very same principles involved in choosing the optimal growth path for an economy. The problem of selecting the optimal growth path and the problem of selecting the optimal method of financing cannot be separated, for they are one and the same.

1. Equivalence of Criteria for Testing Optimality

From the principles of economic growth, the optimal saving rate is the rate which moves an economy to the growth path which provides:

> a higher level of per capita consumption than any other growth path for all time. Once attained, this growth path would be preferred by members of all generations.

The criterion for selecting the optimal financing of pension plans requires the method to:

> 'give every representative man . . . a lifetime consumption profile that he would prefer over any other one available to him and to everyone else'[6].

The two optimality criteria are equivalent. National pension plan financing methods and national saving rates are both judged by whether they move an economy to a higher consumption per capita growth path.

2. Equivalence of Optimality Conditions

The determination of the optimal saving rate and the optimal financing method requires knowledge of the rate of return to capital (r_k). Both optimality problems also require the return to capital to be compared to another economic growth rate. With respect to optimal saving, it is the long run growth rate of the economy ($g+p$). To ascertain the optimal method of financing a national pension plan, the return to capital (r_k) must be compared to the long run growth rate of aggregate earnings (g_e).

It can be shown that when an economy is on a long run growth path, the growth rate of aggregate earnings (g_e) and the growth rate of the economy ($g+p$) are equal. Thus, determining whether pay-as-you-go or investment fund financing is optimal is equivalent to determining if the current saving rate is optimal.

3. The Reasonableness of the Equivalence

The choice between investment fund and pay-as-you-go financing amounts to a choice of whether national pension plan contributions should add to the stock of capital or be transferred directly to current pensioners. The former option increases the saving rate and the latter merely redistributes consumption with no effect on saving.

In light of the principles of economic growth presented in Section I, the reason why investment fund financing is optimal when the return to capital exceeds the growth rate of aggregate earnings is obvious. The introduction of the investment fund involves an increase in the saving rate and the higher saving rate in turn moves the economy to a higher per capita consumption growth path.

If the return to capital is equal to the growth rate in aggregate earnings, pay-as-you-go financing is optimal. The implementation of investment fund financing under this condition would raise saving above the optimal rate and move the economy to a lower, and therefore sub-optimal, per capita consumption growth path. In this situation, the

[6]Samuelson, P. A., *op. cit.* p. 519.

economy is already on the long run growth path that is preferred over all others. Pay-as-you-go financing would merely distribute consumption between earners and pensioners.

Finally, if the growth rate of aggregate earnings exceeds the return to capital, the economy is on a sub-optimal growth path because the saving rate is above the optimal rate. The selection of pay-as-you-go financing is preferred to investment fund financing because the latter would only raise the saving rate and push the economy to an even lower per capita consumption growth path.

4. The "Social Insurance Paradox" Revisited

The social insurance paradox should be less of a paradox in light of the relationship between economic growth and pay-as-you-go and investment fund financing. When the growth rate of aggregate earnings exceeds the return to capital, contributors are better off under pay-as-you-go financing than under investment fund financing because the latter method raises the saving rate and shifts the economy to a lower long run per capita consumption growth path.

Further, if the growth rate of earnings (g_e) exceeds the return to capital (r_k), the optimality conditions imply that not only should a national pension plan be pay-as-you-go financed, but policies designed to lower the saving rate should be implemented. As a result the economy could be moved to a higher long run per capita consumption growth path. A possible policy to lower the saving rate would be to ease the funding requirements for private sector pension plans.

5. The Rate of Return to Capital and the Social Rate of Return

The two optimality problems require a comparison of the rate of return to capital and the growth rate of aggregate earnings. The latter is easily calculated. The former, the return to capital, requires some consideration. From society's perspective, the **social rate of return** on capital is the relevant measure for comparison with the growth of aggregate earnings.

The social rate of return is greater than the private return to capital. The difference between the two is the amount of tax levied on capital. The return to society is not only the return realized by owners of capital, but also the share of the return to capital that is claimed by government through taxes. The social rate of return, because it measures the **gross or total** return to society from capital investment, is relevant for the purposes of evaluating methods of financing national pension plans.

6. The Empirical Relationship Between the Social Rate of Return and the Growth Rate of Aggregate Earnings

The social rate of return on capital and the growth rate of aggregate earnings can be estimated. Between 1965 and 1974 real aggregate earnings in Canada grew at an annual rate of 7.10 per cent. During the same period, the social rate of return on capital in Canada was estimated to be 10.78 per cent[7].

This implies that investment fund financing of a national pension plan is preferred. In terms of economic growth, investment financing by raising the saving rate would move the economy closer to the optimal long run growth path.

However, it must be remembered that there is a cost in terms of foregone consumption (additional saving/investment) borne by the founding generation before the fruits of a higher long run per capita consumption growth path can be realized. Given this consideration, it is not clear that the optimal method of financing is consistent with social and political objectives.

[7]Jenkins, G. P., "Capital in Canada: Its Social and Private Performance 1965-74", Economic Council of Canada, Discussion Paper 98 (Ottawa: Department of Supply and Services, 1977).

IV. The Impact of Demographic Changes on Pay-as-you-go Financing

Pay-as-you-go contribution rates are sensitive to changes in demography. In particular, demographic changes resulting from a reduction in fertility rates, such as Canada is currently experiencing, move the pay-as-you-go financing option further away from optimality.

1. Canada's Demographic Future

Canada can expect reduced population growth if present fertility trends continue. A consequence of the reduced population growth is a significant change in the age distribution of its population. As the post-war baby boom members mature, the number of individuals of pensionable age will increase relative to the number of individuals of working age. Using varying assumptions about fertility rates and immigration, Table 3 illustrates the impact of a reduced population growth on the "pensioner ratio". The pensioner ratio is the number of individuals aged 65-plus divided by individuals aged 14 to 64.

Projected Population and Pensioner Ratios — Table 3

Net Annual Immigration	Year	Total Fertility Rate 1.80 Population (million)	1.80 65+/(14–64)	2.13 Population (million)	2.13 65+/(14–64)	2.50 Population (million)	2.50 65+/(14–64)
40,000	1975	22.359	0.1281	22.550	0.1281	22.765	0.1281
	2000	27.200	0.1727	29.226	0.1647	31.573	0.1566
	2025	28.590	0.2864	33.782	0.2440	40.412	0.2068
	2050	26.716	0.3090	35.984	0.2536	49.150	0.2076
160,000	1975	22.773	0.1263	22.967	0.1263	23.185	0.1263
	2000	30.745	0.1587	32.925	0.1519	35.447	0.1450
	2025	35.634	0.2597	41.448	0.2258	48.832	0.1949
	2050	36.888	0.2799	47.693	0.2367	62.867	0.1984

Source: Pesando, J. and S. Rea, Jr., *Public and Private Pensions in Canada: an Economic Analysis* (Toronto: University of Toronto Press, 1977).

2. Impact of Demographic Changes on the Financing Decision

To ascertain optimality, the return to capital must be compared to the growth in aggregate earnings. The growth rate in aggregate earnings is equal to the rate of employment growth plus the rate of growth of earnings per worker. A decline in the population growth rate means an eventual decline in the growth rate of the labour force and, as a consequence, a lowering of the rate of growth of aggregate earnings relative to the return on capital.

Considering that the estimates of the economic return to capital (10.8 per cent) and the growth rate in aggregate earnings (7.1 per cent) already reveal pay-as-you-go financing to be sub-optimal, the expected reduction in the earnings growth rate because of the decline in population growth moves the pay-as-you-go financing option even further away from optimality.

3. Impact of Demographic Changes on Pay-as-you-go Contribution Rates

Another dimension to the decline in population growth is that pay-as-you-go contribution rates will have to increase if pension commitments are to be honoured.

Assuming the ratio of average pensions to average earnings remains unchanged, the actual increase in the pay-as-you-go contribution rate depends on the increase in the number of pension recipients relative to the number of pension contributors. The change in the pensioner ratio gives a rough indication of the tax rate on earnings that will be necessary to finance a pay-as-you-go pension system.

Employing the projected pensioner ratios of the six demographic scenarios presented in Table 3, corresponding pay-as-you-go tax rates can be calculated. Repeating the tax calculation for selected years and comparing the results to the 1975 base year, the demographic impact on pay-as-you-go contribution rates can be illustrated. This is done in Table 4.

Demographic Impact on Pay-as-you-go Contribution Rate[1] Table 4

Net Immigration	Year	Contribution Rate in Selected Year (%)			Ratio of Contr. Rate to 1975 Contr. Rate		
		Total Fertility Rate					
		1.80	2.13	2.50	1.80	2.13	2.50
40,000	1975	3.20	3.20	3.20	1.00	1.00	1.00
	2000	4.32	4.12	3.92	1.35	1.29	1.22
	2025	7.16	6.10	5.17	2.24	1.90	1.61
	2050	7.73	6.34	5.19	2.41	1.98	1.62
160,000	1975	3.16	3.16	3.16	1.00	1.00	1.00
	2000	3.97	3.80	3.63	1.26	1.20	1.15
	2025	6.49	5.65	4.87	2.06	1.79	1.54
	2050	7.00	5.92	4.96	2.22	1.87	1.57

[1]Contributions calculated assuming pensions are 25 per cent of the average wage.

Depending on the demographic scenario cited, pay-as-you-go contribution rates between 1975 and 2050 will increase by at least 57 per cent and possibly by as much as 141 per cent. Under the more conservative demographic scenarios, the willingness of the future generation of workers to continue to finance the real value of pensions promised comes into question. Further, if pension benefits are increased relative to real wages, or if the eligibility age is lowered, pay-as-you-go contribution rates would even be higher. In these instances the security of the pension promises may become of even greater concern.

4. Impact of Demographic Changes on the Investment Fund Contribution Rate

The reduction in the growth rate of Canada's population makes the optimality of investment fund financing more obvious. In exchange for small increases in the pension contribution rates of today's workers under the investment fund financing option, the need for substantial increases in pay-as-you-go contribution rates in the future can be eliminated.

Under investment fund financing, the reserves accumulated, or rather the additional real assets represented by the accumulated reserves, provide future pension benefits. As the members of the baby boom retire, pensions can be financed by drawing down the investment fund rather than by increasing contributions. The investment fund can be interpreted as an economic "buffer" between changes in the pensioner ratio and a national pension plan's contribution rate.

V. The Impact of Pay-as-you-go Financing on the Saving Rate

The impact of pay-as-you-go national pensions on saving is currently a hotly debated and unresolved economic issue. As usual, there are two opposing views. The view that the unfunded nature of pay-as-you-go financing depresses saving is identified with Martin Feldstein of Harvard University.[8] The main spokesman for the opposing view that pay-as-you-go financing does not affect the saving rate is Robert Barro of the University of Rochester.[9]

1. The Importance of the Issue

In Section I of this paper, it was shown that rate of saving is an important factor in determining an economy's long run growth path. Assuming the saving rate is below optimal, raising (lowering) an economy's saving rate will shift it to a higher (lower) per capita consumption growth path.

Accepting that an economy's saving rate is below optimal (which statistical evidence suggests is the case in Canada), then a pay-as-you-go national pension plan which depresses the saving rate shifts the economy to a lower long run consumption per capita growth path. If this is the situation, the generation founding the national pension plan reduces the per capita consumption of all future generations.

Conversely, if pay-as-you-go financing does not affect the saving rate, the economy remains on its original long run growth path. Future generations are unaffected.

2. The Extended Life Cycle Model of Saving (Feldstein)

Feldstein's contention that pay-as-you-go financing depresses saving is based on the statistical testing of his Extended Life Cycle Model of Saving.

Feldstein argues that a primary motive for saving is to provide a stream of income during retirement. The longer the retirement period is expected to be, the more an individual will save during his working years. With the introduction of a national pension plan with compulsory contributions and guaranteed pension benefits, individuals reduce their personal saving for retirement because part of their desired income stream in retirement will be provided by the government. This is termed "the substitution effect".

Simultaneously, national pension plans, with their institutionalized retirement age and their provision of income to the aged, induce the aged to retire and raise the expectations of a longer retirement period in the minds of those still in the labour force. In response to this, saving for retirement is increased. This is termed "the induced retirement effect".

The net impact of national pension plans on personal saving depends upon whether the negative substitution effect or the positive induced retirement effect dominates. Using time series data for the United States and international cross-sectional data, Feldstein has tentatively concluded that national pension plans reduce the personal saving rate as well as the private saving rate.

In the case of the United States, because its national pension plan is pay-as-you-go financed and not investment fund financed, Feldstein argues that the reduction in personal saving has not been compensated for. As a result, the overall rate of private saving has been reduced. Feldstein estimates that the rate of private saving has been reduced by 38 per cent. In terms of economic growth, the lower saving rate has shifted the U.S. economy to a lower long run growth path with a lower level of capital stock.

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[8]Feldstein, M. S., "Social Security and Saving: The Extended Life Cycle Theory", *American Economic Review*, Vol. 66, 1976, pp. 77-86.

[9]Barro, R. J., "Are Government Bonds Net Wealth?", *Journal of Political Economy*, Vol. 82, 1974, pp. 1092-1118.

According to Feldstein's estimates, the cost of the shift in foregone national income to the U.S. in 1972 was $173 billion, or 15 per cent of the United States GNP.[10]

3. An Intergenerational Transfer

If a national pension plan does lower the rate of personal saving, and if government policies do not compensate for the loss of saving, the resultant lowering of the long run stock of capital can be interpreted as an intergenerational transfer. Specifically, the generation founding a pay-as-you-go pension plan increases its consumption, while following generations pay the price of the increased consumption by inheriting a lower level of capital stock. The reduction in capital lowers future income and future per capita consumption.

The members of the founding generation, in effect, redistribute income from future generations to themselves.

4. Voluntary Intergenerational Transfers: An Alternative Extended Life Cycle Model of Saving (Barro)

Barro agrees with the Life Cycle Model of Saving but argues that each generation values the economic well-being of future generations. If this hypothesis is true, then the generation founding a pay-as-you-go national pension plan and all subsequent generations will resist the redistribution of consumption from their heirs to themselves by voluntarily increasing bequests.[11]

According to Barro, the extra saving required for the increased bequests offsets the negative impact pay-as-you-go national plans have on personal saving. Examples of voluntary bequests from one generation to another include investment in human capital through the education of progeny and accumulated wealth bequeathed at the time of death.

If voluntary transfers do compensate for the negative impact of pay-as-you-go pension plans on personal saving, then there is no intergenerational redistribution of income.

5. Empirical Evidence: United States and Canada

Empirical studies which try to estimate the impact national pension plans have on saving are lengthy and complex. The following material briefly summarizes the results.

(i) United States Empirical Evidence

The U.S. public pension system, Old Age Security and Disability Insurance (OASDI), has been in operation since 1935. To date, seven major empirical studies attempting to estimate its impact on personal saving are available.[12] Their conclusions are contradictory.

Feldstein and Munnell, the economists most identified with the view that public pensions lower saving, initiated the debate by publishing the results of academic research which indicated that OASDI reduced personal and private saving. Essentially they

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[10]Feldstein, M. S., "Social Security, Induced Retirement and Aggregate Capital Accumulation", *Journal of Political Economy*, Vol. 82, 1974, pp. 922-3.

[11]Barro, R. J., *op. cit.*

[12]The seven studies are:

(i) Barro, R. J., "Social Security and Private Saving: New Evidence from the U.S. Time Series" (mimeo: University of Rochester, 1977).

(ii) Barro, R. J. and G. M. MacDonald, "Social Security and Consumer Spending in an International Cross Section" (mimeo: University of Rochester, 1977).

(iii) Feldstein, M. S., "Social Security and Private Saving: International Evidence in an Extended Life Cycle Model", Harvard Institute of Economic Research, Discussion Paper 361 (mimeo: Harvard University, 1974).

(iv) Feldstein, M. S., "Social Security, Induced Retirement and Aggregate Capital Accumulation", *Journal of Political Economy*, Vol. 82, 1974, pp. 905-26.

(v) Munnell, A., *The Effect of Social Security on Personal Saving* (Cambridge: Ballinger, 1974).

(vi) Munnell, A., "Private Pensions and Saving: New Evidence", *Journal of Political Economy*, Vol. 84, 1976, pp. 1013-32.

(vii) Turner, J. A., "Social Security, Saving and Labour Supply" (mimeo: Washington, D.C., 1978).

argue that, with respect to the U.S. public pension system, the negative substitution effect has dominated the positive retirement effect.

Subsequent studies by Barro and Turner, using similar data and structured on further theoretical developments of the Life Cycle Model of Saving, produced contradictory results.

Barro contends that increases in voluntary intergenerational transfers compensate for any negative effect public pensions have on saving behaviour. After adjusting for voluntary transfers using a proxy variable, the statistical evidence indicates the OASDI has no effect on saving in the United States.

Turner's study, which is the most recent, takes into account not only voluntary transfers between generations but also the positive effect the OASDI retirement test has on the amount of labour supplied by the pre-retirement working population. The study concludes that the U.S. public pension system has a positive effect on saving.

(ii) Canadian Empirical Evidence

Public pensions are a relatively recent government policy initiative in Canada (Old Age Security in 1952, Guaranteed Income Supplement and Canada and Quebec Pension Plans in 1966), consequently, studies of their impact are limited. At present only four studies designed to statistically estimate the impact of Canada's public pension system on personal saving are available.[13]

A 1974 empirical study undertaken by the federal Department of National Health and Welfare (NHW) estimated the impact the CPP/QPP had on personal saving over the period 1962-73. Although the results indicated contractual saving was reduced by 40 cents for each dollar of CPP/QPP contributions, this reduction was more than offset by a marked increase in discretionary personal saving.

Using a methodology similar to the NHW study, the federal Treasury Board Secretariat estimated that the introduction of the CPP/QPP may have reduced personal saving by about 10 per cent. The paper emphasized that the surplus generated by the partially funded CPP/QPP was more than sufficient to offset the reduction in personal saving. The period investigated was 1957 to 1975.

A study by the Ontario Treasury investigated the impact of OAS/GIS and CPP/QPP retirement benefits and the extent of coverage of the two national pension systems on the rate of personal saving. The estimated reduction in saving ranged between 1.8 and 14 per cent. Again, the reserve accumulated by the partially funded CPP/QPP has been sufficient to offset the estimated reduction in personal saving.

The most recent study available has been undertaken by Boyle and Murray of the University of British Columbia. Unlike previous pension studies using Canadian data, their methodology directly parallels U.S. research efforts of Feldstein and Munnell.

The study concludes that Canada's public pension system has had no visible impact on household saving behaviour. Boyle and Murray explain their results by arguing that the expected negative impact of guaranteed public pension benefits on saving behaviour has probably been offset not only by the positive retirement effect, but also by the presence of effective tax shelters (such as the RRSP and RHOSP), increased personal saving rates because of higher levels of personal income and possibly the presence of intergenerational transfers as advanced by Barro.

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[13]The four Canadian studies are:

(i) Boyle, P. P. and J. Murray, "Social Security Wealth and Private Savings in Canada", University of British Columbia, Working Paper 54 (mimeo: University of British Columbia, 1978).

(ii) Horner, K. and M. Gusta, "Implications of the Expansion of Public Pensions for Investment in Canada", Long Range Planning Directorate, Department of National Health and Welfare (mimeo: Ottawa, 1974).

(iii) La Pointe, D. H., "The Impact of the CPP on Saving", Planning Branch, Treasury Board (mimeo: Ottawa, 1978).

(iv) "Public Pensions and Personal Saving: Canadian Evidence in the Extended Life Cycle Model", Taxation and Fiscal Policy Branch, Ministry of Treasury, Economics and Intergovernmental Affairs (mimeo: Toronto, 1977).

6. Concluding Comment

The impact public pensions have on saving is a controversial and unsettled issue. Results of statistical studies in the U.S. and Canada provide conflicting conclusions. If national pension plans expand in coverage and provide more generous benefits, it will become more important to understand the economic consequences of pay-as-you-go and investment fund financing.

Final Comments

1. Summary

This paper has examined the economics of financing national pension plans from the perspective of economic growth. Through its impact on the saving/investment rate, it is recognized that a national pension plan can affect an economy's long run growth.

An investment funded plan which increases the rate of saving/investment will move an economy to a higher growth path with a future increase in per capita consumption. However, there is a cost to this increased future consumption. The cost is measured by the decreased consumption (increased saving) by the generation founding the national pension plan.

Under pay-as-you-go financing individuals may, in expectation of government pensions, reduce their saving for retirement (increase consumption) and thus reduce the overall saving rate. This would decrease the per capita consumption of future generations below levels which would have otherwise prevailed. To date, empirical studies examining the impact of pay-as-you-go pension plans on national saving rates are contradictory. Assertions that pay-as-you-go financed national pension plans necessarily lower saving rates are, to some extent, conjecture.

The impact of demography on contribution rates was also examined. It was noted that the decline in fertility rates will eventually result in an increase in the number of pensioners relative to individuals of labour force age. Under pay-as-you-go financing this will result in an increased contribution rate. In contrast, investment fund contributions are immune to demographic shifts. As the members of the baby boom retire, promised pensions are paid by drawing down the investment fund, not by raising contribution rates.

2. Some Caveats

It must be emphasized that an increase in the saving rate has been assumed to mean a simultaneous increase in the investment rate. The economic benefits of investment fund financing can only be realized if the intended increase in saving is matched by an increase in intended investment.

Under the current financial structure of the Canada Pension Plan, surplus CPP contributions and interest earnings are loaned to the participating provincial governments. With regard to Ontario, CPP borrowings have helped finance the province's social and economic infrastructure.[14] An investment fund financed CPP would only be optimal if it continues to add to Canada's capital stock.

Finally, it should be remembered that reference has not been made to Canada's foreign sector. If an investment funded national pension plan is instituted, domestic interest rates would fall. To the extent that foreign capital is sensitive to interest rate differentials, investment fund financing would result in the substitution of domestic for foreign saving. The greater the degree of substitution, the smaller the increase in Canada's domestic rate of saving/investment.

The actual degree of substitution can only be determined empirically. The Economic Council of Canada is currently investigating this issue as part of its research on Canada's retirement income policies.

[14]The Hon. W. Darcy McKeough, Budget Paper 'B', "Ontario's Borrowing and Public Capital Creation", *1978 Ontario Budget*, Toronto, Ministry of Treasury, Economics and Intergovernmental Affairs, 1978.

The Financing of Public and Private Pension Plans: An Analysis from Two Perspectives

Table of Contents

Introduction

This paper evaluates the financing of pension plans from two perspectives: financial and economic. From the financial perspective, the examination of historical data indicates national pension plans should be pay-as-you-go financed. With investment fund financing, an individual employer-sponsored pension plan can provide retirement benefits at lower contribution rates than available under pay-as-you-go financing. The magnitude of the cost reduction depends upon the assets held by individual plans. However, if all employer-sponsored plans were amalgamated, pay-as-you-go financing would be preferred.

From an economic perspective the conclusions differ. In all cases pension plans, whether national or employer-sponsored, should be investment fund financed. This is not because the contribution rates would necessarily be lower than comparable pay-as-you-go rates, but because of the **total** economic benefit generated by capital investment. The total economic benefit includes not only the return earned by the pension fund but also a return that is **external** to the plan and collectively realized by society.

Section I of the paper presents the reader with a brief introduction to fundamental principles of pay-as-you-go and investment fund financing. With this preparation, Section II evaluates both national and individual employer-sponsored pension plans from a financial perspective. An economic evaluation of pension financing follows in Section III.

I. Pay-as-you-go and Investment Fund Financing

Pension plans can either be pay-as-you-go or investment fund financed. The latter method provides a fund whose assets are equal to accrued pension benefits, and contributions accumulated in the fund earn an interest return. Pay-as-you-go financing generates no fund. The security of accrued benefits rests on the willingness of current and future active plan members to continue contributing. Because there is no fund, pension contributions do not earn an explicit interest return.

Although the two financing methods appear diametrically opposed, they are nonetheless closely related. By examining pay-as-you-go and investment fund financing in more detail their close relationship will become clear. Further, once their interrelationship is appreciated, noteworthy implications for the financing of pension plans follow.

1. Principal Assumptions

The following analysis assumes a final earnings pension plan. For simplicity, benefits are assumed to be indexed to real wages. The consideration that an investment fund provides security for pension benefits accrued to participants of an employer-sponsored pension plan is disregarded. The choice between investment fund and pay-as-you-go financing is solely determined by which is more financially or economically efficient.

The analysis also assumes that the relative values of the aggregate earnings growth rate (g) and the interest rate (i) remain stable over the lifetimes of pension plan participants.

2. Pay-as-you-go Financing

Under pay-as-you-go financing the contribution rate is established so current contributions equal current expenditures of the plan. No fund is accumulated. In the early years of the plan, few individuals receive full pension benefits and, as a consequence, initial expenditure levels and contribution rates are low. As the plan matures the number of beneficiaries increase and the contribution rate increases accordingly. When the plan is mature, contributions and benefit expenditures grow at the growth rate of aggregate earnings (g). A stable relationship between the number of pensioners and contributors ensures the stability of the long run or mature pay-as-you-go contribution rate.

Although no fund is accumulated, pay-as-you-go contributions do earn an implicit return. It is equal to the growth rate of aggregate earnings (g) and is realized when pensions are paid to former contributors.

It should be noted that the growth rate of aggregate earnings (g) is equal to the **sum** of the growth rates of plan contributors (p) and average earnings of contributors (w).[1]

3. Investment Fund Financing

The contribution rate of an investment fund financed pension plan is determined by the actuarial cost of the pension, not the estimated current expenditures of the plan. As a result, an investment fund is accumulated which is equal to the accrued value of earned pension benefits. Such a plan is "fully funded".

Prior to plan maturity, expenditures will be small and the fund will rapidly accumulate at a rate equal to the inflow of contributions plus the interest (i) earned on the fund. Upon maturity, contributory revenue and pension expenditures both grow at the rate of aggregate earnings (g).

4. Interrelationship of the Two Financing Methods

Significantly, the fully funded contribution rate will approximate the mature pay-as-you-go rate. Whether the funded contribution rate is less than, greater than, or equal to the pay-as-you-go rate depends upon the relative magnitudes of the interest rate (i) earned by contributions accumulated in the fund and the growth rate of aggregate

[1]This relationship applies to the continuous case. With discrete time periods $g = p + w + pw$.

earnings (g). If *i* exceeds *g*, the investment fund contribution rate is lower than the pay-as-you-go rate. If *i* is less than *g*, the pay-as-you-go contribution rate is lower. And finally, if *i* equals *g*, the contribution rates under the two methods of financing are identical. These relationships exist because the fully funded characteristic of an investment fund pension plan must be maintained. The following three cases illustrate this point.

(i) Three Cases

Case 1: Interest Rate (i) = Growth Rate of Aggregate Earnings (g)

Liabilities of a pension plan increase at the rate of growth of aggregate earnings of the plan's contributors. To ensure the plan is fully funded, assets must be accumulated to balance the accruing liabilities. When mature, the principal source of increasing a pension fund's assets is the interest earned on previously accumulated contributions. If the interest rate earned (i) equals the growth rate of accruing liabilities (g), the growth of the plan's assets is exactly matched by the growth of the plan's liabilities. The fully funded status of the plan is maintained.

Interestingly, since the funded status of the plan is maintained solely by interest earnings, all of current contributions can be used to finance pension benefits. This precisely parallels the operation of a mature pay-as-you-go pension plan and it follows that the contribution rates under the two financing methods must be equal. The only difference between the two is the presence of a growing investment fund.

Case 2: Interest Rate (i) > Growth Rate of Aggregate Earnings (g)

When the interest rate (i) earned on accumulated contributions exceeds the growth rate of aggregate earnings (g), it also exceeds the growth in the plan's liabilities. The excess investment earnings can be used to help pay pension benefits. Since interest earnings assist the payment of benefits, it is not necessary for current contributions to equal current pension benefits and this is translated into a lower contribution rate relative to pay-as-you-go financing.

Under these circumstances, investment fund financing becomes a mechanism for lowering the cost of pension benefits.

Case 3: Interest Rate (i) < Growth Rate of Aggregate Earnings (g)

In the final situation, accruing liabilities of a funded plan grow faster than investment income earned by past contributions. To maintain the plan's fully funded status, the investment fund must be steadily supplemented to ensure there are sufficient assets to meet the growing liabilities. The additional source of financing is an increased contribution rate.

When *i* is less than *g*, current contributions under investment fund financing not only pay current pension benefits, they also supplement the investment fund. Under pay-as-you-go financing contributions are only needed to pay pension benefits. As a consequence, the investment fund financing contribution rate must be higher than the pay-as-you-go rate.

(ii) Numerical Illustration

Table 1 numerically illustrates the preceding three cases. The example pension plan provides a retirement benefit that is 25 per cent of final earnings and indexed to real wages.

Interrelationship of Contribution Rates Under Pay-as-you-go and Investment Fund Financing — Table 1

Relationship between i and g	Contribution Rate (%)	
	Investment Fund	Pay-as-you-go
i = g	7.2	7.2
i > g by 2.0%	3.8	7.2
i < g by 2.0%	12.6	7.2

[1]Contribution rates calculated assuming a 47-year contributory period and life expectancy after retirement of 13.5 years. Retirement pension is 25 per cent of average earnings and indexed to the wage level.

When i equals g, the contribution rates under pay-as-you-go and investment fund financing are both 7.2 per cent. When i exceeds g by 2 percentage points, the interest earnings grow faster than accumulating liabilities and the extra earnings are used to reduce the investment fund contribution rate to 3.8 per cent. Finally, when g exceeds i by 2 percentage points, pension liabilities accrue faster than the growth in interest earnings. This results in a growing liability that can only be met by the higher contribution rate of 12.6 per cent.

II. The Financing of Pensions: A Financial Perspective

An evaluation of pension plans from a financial perspective is intended to ascertain whether pay-as-you-go or investment fund financing provides pension benefits at the lowest cost. Obviously the lowest cost method is preferred. It should be noted, however, that the preferred method using financial criteria may not correspond to the financing method selected when using economic criteria. This issue is examined in Section III.

1. Selection Criteria

The interrelationship between the growth rate of earnings (g) and the interest rate (i), and its impact on contribution rates under pay-as-you-go and investment fund financing have been explained in Section I. Now, viewing *g* as the **implicit** return to contributions under pay-as-you-go financing and *i* as the **explicit** return to contributions accumulated in an investment fund, the criteria for establishing which method provides the lowest cost pension merely involves a comparison of the two rates of return.

If the interest rate (i) earned by the fund exceeds the growth rate of aggregate earnings (g), the investment fund contribution rate is lower than the mature pay-as-you-go rate and the former method of financing is preferred. Conversely, if *g* exceeds *i*, pay-as-you-go financing provides pension benefits at the lowest long run cost. Finally, if *i* equals *g*, the contribution rates are identical and neither method of financing is preferred.[2] These relationships are summarized in Table 2.

Selection Criteria — Table 2

Financial Conditions	Preferred Financing Method
$i > g$	Investment fund
$i = g$	Either method is acceptable
$i < g$	Pay-as-you-go

It is emphasized that the established selection criteria are appropriate only when comparing investment fund contribution rates to **mature** pay-as-you-go contribution rates. The founding participants of an immature pay-as-you-go pension plan would prefer pay-as-you-go financing because initial contribution rates would always be below the investment fund contribution rate.

2. Amended Selection Criteria

The Canadian pension system is a combination of two nationally administered pension plans (CPP/QPP, OAS/GIS) and over 15,000 independently operated private and public sector employer-sponsored pension plans.[3] The contributory base of nationally organized pension plans such as the CPP/QPP is the total employed labour force. Independent employer-sponsored pension plans have a much narrower contributory base. This difference is fundamental and the above selection criteria must be amended accordingly.

(i) Implicit Return to Pay-as-you-go Financing

As noted in Section I, the aggregate growth rate of earnings (g) is equal to the sum of the growth rates in the number of plan participants (p) and their average earnings (w). Although a nationally administered pension plan financed on a pay-as-you-go basis can rely on both a growing contributory base and the growth in average earnings, independent employer-sponsored pension plans cannot. It is reasonable to assume average earnings paid by employers will keep pace with the growth of average earnings

[2]The selection criteria can be interpreted in terms of economic growth. When *i* exceeds *g*, an increase in the saving/investment rate (investment fund financing) moves the economy to a higher per capita consumption growth path. See "The Economics of Financing National Pension Plans" in this publication.

[3]Statistics Canada, *Pension Plans in Canada*, Catalogue No. 74-401, 1976.

throughout the economy but it is not reasonable to assume the growth in a company's labour force (the contributors to the pension plan) will match the growth of the nation's labour force. As a consequence, the implicit return available to employer-sponsored pension plans under pay-as-you-go financing is restricted to the growth rate of average earnings (w). The amended criteria are summarized in Table 3.

Amended Selection Criteria — Table 3

Nationally Administered Pension Plans	
$i > g = p + w$	Investment fund
$i = g = p + w$	Either method is acceptable
$i < g = p + w$	Pay-as-you-go
Employer-Sponsored Pension Plans	
$i > w$	Investment fund
$i = w$	Either method is acceptable
$i < w$	Pay-as-you-go

(ii) Explicit Return to Investment Fund

A wide variety of financial instruments is available to funded pension plans and the return to any plan is the weighted average of the returns to the different securities held by the fund. The portfolio rate of return concept is beyond the scope of this paper. Evaluation has been restricted to a number of different bond rates, the conventional mortgage rate and a common stock index with reinvested dividends. These compounded rates of return for the periods 1952-76 and 1965-74 are presented in Table 4.

Selected Rates of Return[1] — Table 4
(per cent)

	Evaluation Period 1952-76	1965-74
Section A: Employment Growth		
Total Civilian Employment	2.55	3.35
Civilian Non-agricultural Employment	3.18	3.83
Section B: Earnings Growth		
Aggregate Earnings	9.75	12.18
Net Aggregate Earnings (Total)	7.02	8.54
Net Aggregate Earnings (Non-Agricultural)	6.37	8.04
Section C: Financial Rates of Return		
Public and Private Sector Bond Rates		
• Government of Canada Average Bond Yield (10 years and over)	5.73	6.97
• McLeod Young Weir Provincial Bond Index (10 years or less)	6.41	7.80
• McLeod Young Weir Municipal Bond Index (10 years or less)	6.73	8.06
• McLeod Young Weir Industrial Bond Index (10 years or less)	6.65	8.03
• McLeod Young Weir Total Bond Index (40 years or less)	6.59	7.98
Private Sector Equities		
• Conventional Mortgage Rate	8.00	9.15
• Common Stock Index (Reinvested Dividends)	8.12	5.09
Section D: Social Rate of Return		
Social Rate of Return to Private Sector Investment	n/a	10.78

[1]Sections A, B, and C are in nominal terms; Section D is in real terms. For data see Appendix.

3. Financial Evaluation (1952-1976)

(i) National Pension Plans

Table 5 compares various explicit investment returns to the implicit pay-as-you-go return available to a national pension plan during the 25 years from 1952 to 1976. As the last column of the table demonstrates, the compound growth rate of aggregate earnings has exceeded the compound interest rates attached to the five bond indices as well as the conventional mortgage rate and the common stock index. The differential ranges from a low of 1.63 per cent when compared to the common stock index to a high of 4.02 per cent when compared to Government of Canada Bonds. From a financial perspective, this indicates pay-as-you-go financing is preferred for national pension plans.

Financial Rates of Return for National Pension Plans, 1952-1976
(per cent)

Table 5

Type of Issue	Investment Fund Rate of Return	Pay-as-you-go Rate of Return	Differential
Provincial Bond Index	6.41	9.75	—3.34
Municipal Bond Index	6.73	9.75	—3.02
Industrial Bond Index	6.65	9.75	—3.10
Total Bond Index	6.59	9.75	—3.16
Government of Canada Bonds	5.73	9.75	—4.02
Conventional Mortgage Rate	8.00	9.75	—1.75
Common Stock Index	8.12	9.75	—1.63

(ii) Employer-Sponsored Pension Plans

Table 6 compares the selected investment returns to the implicit pay-as-you-go return available to non-nationally organized pension plans. Because employer-sponsored pension plans cannot depend upon a growing labour force, this factor has been excluded from the latter return. For the non-agricultural sector the approximate pay-as-you-go rate of return over the period 1952-76 was 6.37 per cent.

Financial Rates of Return for Employer-Sponsored Pension Plans, 1952-1976
(per cent)

Table 6

Type of Issue	Investment Fund Rate of Return	Pay-as-you-go Rate of Return	Differential
Provincial Bond Index	6.41	6.37	+0.04
Municipal Bond Index	6.73	6.37	+0.36
Industrial Bond Index	6.65	6.37	+0.28
Total Bond Index	6.59	6.37	+0.22
Government of Canada Bonds	5.73	6.37	—0.64
Conventional Mortgage Rate	8.00	6.37	+1.63
Common Stock Index	8.12	6.37	+1.75

With the exception of the return on Government of Canada Bonds, investment fund rates of return exceed the implicit pay-as-you-go return by between 0.04 and 1.75 percentage points. The relatively low rates of return on provincial, municipal and corporate bonds give investment fund financed pension plans little leverage in lowering contribution rates below pay-as-you-go rates. In contrast, employer-sponsored pension plans with portfolios favouring equity and mortgages possess a greater potential for reducing pension costs. Finally, the return to Government of Canada Bonds is below the implicit pay-as-you-go return. If Canada Bonds were the only assets available, pay-as-you-go financing would be preferred to investment fund financing.

(iii) Employer-Sponsored Pay-as-you-go Financed Pension Plans

Individual employer-sponsored pension plans cannot depend upon labour force growth to assist pay-as-you-go financing, but collectively they can. By amalgamating all employer-sponsored pension plans, the growth in the labour force can be collectively exploited. This raises the pay-as-you-go return above the investment fund financing returns and makes the former method preferable.

This result is not surprising since the amalgamation of employer-sponsored pension plans is tantamount to creating a new national pension plan. The rates of return in Table 5 have already indicated pay-as-you-go financing is preferred for national pension plans.

Thus, **in principle,** employer-sponsored pension plans can be satisfactorily financed on a pay-as-you-go basis. The qualification "in principle" is underscored because the amalgamation of the myriad of individual pension plans with their diverse benefit and financing structures would neither be easy nor necessarily desirable.

III. The Financing of Pensions: An Economic Perspective

From a financial perspective a pay-as-you-go national pension plan is preferred. Further, if employer-sponsored pension plans could be amalgamated to exploit the growth of the labour force, pay-as-you-go financing would again be preferred. Under the existing structure, individual pension plans prefer investment fund financing.

However, applying economic criteria to the financing question yields different conclusions. Regardless of whether or not a pension plan is able to benefit from the growth of the labour force, investment fund financing is preferred.

1. Selection Criteria

The financial evaluation required the comparison of the aggregate growth rate of earnings with the interest return yielded by various financial instruments. An economic evaluation requires a similar comparison, but instead of employing measures of financial return the **social rate of return on capital investment** is used.

The social rate of return (r) measures the **total return to society** from additional capital investment. This is greater than the financial returns available to the pension fund. The difference is comprised not only by the spread between the return earned by the economic agent undertaking the investment and the interest yield of the associated debt instrument, but also the return to capital investment claimed by government through taxes. Thus, from society's perspective, the economic benefit from investment fund financing is not adequately represented by the financial returns earned by pension funds. The benefits derived from investment fund financing that are **external** to a pension system must also be incorporated.

The economic criteria for evaluating pension financing are presented in Table 7.

Economic Selection Criteria — Table 7

Economic Condition	Financing Implication
Social Rate of Return (r) $>$ g $=$ p $+$ w	Investment fund
Social Rate of Return (r) $=$ g $=$ p $+$ w	Either method is acceptable
Social Rate of Return (r) $<$ g $=$ p $+$ w	Pay-as-you-go

2. Economic Evaluation (1965-1974)

The social rate of return to capital investment in Canada's industrial sector has been estimated to be 10.78 per cent in real terms.[4] Before a satisfactory comparison can be undertaken, the growth rate of aggregate earnings (g) must also be expressed in real terms. This is accomplished by dividing nominal aggregate earnings by the Consumer Price Index before calculating its compound growth rate. The two rates of return measured over the period 1965-74 are presented in the following table.

Economic Rates of Return for National Pension Plans, 1965-1974 — Table 8
(per cent)

Real Social Rate of Return	10.78
Real Growth Rate of Aggregate Earnings	7.10
Difference	3.68

The difference between the two returns is 3.68 percentage points. The social return to capital investment is 50 per cent greater than the implicit return available from pay-as-you-go financing. This clearly indicates that from an economic perspective investment fund financing of national pension plans is preferred. Further, since the pay-as-you-go return to individual plans is less than that available to a nationally organized system, investment fund financing is also preferred by employer-sponsored pension plans.

[4]Jenkins, G. P., "Capital in Canada: Its Social and Private Performance 1965-74", Economic Council of Canada, Discussion Paper 98 (Ottawa: Department of Supply and Services, 1977).

3. Investment Fund Financed National Pension Plans: Additional Implications

The major implication of the economic evaluation is that national pension plans should be investment fund financed in a manner similar to employer-sponsored plans. To gain a greater appreciation of the consequences of investment fund financing, additional implications will be discussed.

(i) Contribution Rate

Although investment fund financing yields a return that is higher than is available from pay-as-you-go financing, it does not follow that the investment fund contribution rate is necessarily lower than the pay-as-you-go rate. This is because the financial return and not the full value of the economic return is paid to the pension fund. If the financial return received by the national pension plan is less than the nominal growth in aggregate earnings, then the investment fund contribution rate will exceed the pay-as-you-go rate. Under this circumstance the economic advantage of investment fund financing is not reflected in the national pension plan's contribution rate.

Interestingly, the rates of return presented in Table 5 suggest that this is the probable situation. Over the observed period the nominal pay-as-you-go return was greater than the returns to available financial instruments. As a consequence, an investment fund financed national pension plan would have relatively high contribution rates despite the high economic return generated.

(ii) External Benefits

Because national pension plan contribution rates do not reflect the high social rate of return, this does not mean the economic benefit of investment fund financing is lost. The difference between the financial return earned by the fund and the social rate of return is divided between the economic agents undertaking the real investment and the levels of government receiving taxes levied on capital. Table 9 indicates that the estimated return on capital claimed by government through taxes is 4.88 per cent, or about one-half the value of the social rate of return. The full economic return is still generated, but a significant portion of the return is **external** to the pension plan.

Composition of Social Rate of Return — Table 9
(per cent)

Real Social Rate of Return	10.78
Real Private Rate of Return	5.90
Real Return Claimed by Government Sector	4.88

Source: Jenkins, G. P., "Capital in Canada: Its Social and Private Performance", Economic Council of Canada, Discussion Paper 98 (Ottawa: Department of Supply and Services, 1977).

As members of society, national pension plan participants do benefit, albeit indirectly, from the full economic return. The principal source of benefit is the additional tax revenues which are generated by investment fund financing and distributed by government through the provision of public goods and services and income transfers. Although their incidence would be difficult if not impossible to assess, and their presence not associated with the financing of a national pension plan, the external benefits to investment fund financing are real and must be recognized to exist. It is the presence of the external benefits that makes investment fund financing economically superior to pay-as-you-go financing over the long run.

(iii) Consequences of an Expanded Pay-as-you-go National Pension Plan

If the social rate of return exceeds the real growth rate of aggregate earnings, an expanded pay-as-you-go national pension plan would reduce economic well-being. This occurs because the expanded national plan would most certainly displace investment fund financed employer-sponsored plans. Although the contribution rate would be less under the pay-as-you-go national plan, the loss of external benefits generated by the

employer-sponsored plans would more than outweigh the benefit of the reduced contributions. The elimination of external benefits results in a net reduction in overall economic well-being.

The reduction in economic well-being can be interpreted as an increase in taxes. Since the displacement of investment fund financed employer-sponsored plans implies a corresponding reduction in tax revenue, government sector goods and services and income transfers can only be maintained if other taxes are increased. Thus the benefit of a reduced contribution rate is offset by a tax increase. But the economic return to investment fund financing exceeds the implicit return to pay-as-you-go financing. This means the tax increase needed to maintain the initial level of government sector activity more than offsets the reduction in pension contributions. There is a net decline in disposable income. The financial benefit of substituting pay-as-you-go for investment fund financing is illusory.

Conclusion

This paper has evaluated the financing of pensions from the financial and economic perspectives. The financial evaluation indicates participants of national and amalgamated employer-sponsored plans would prefer pay-as-you-go financing. In contrast, an economic evaluation indicates investment fund financing is preferred for all pension plans. This is not because the contribution rate would necessarily be lower than the **mature** pay-as-you-go rate, but because of the additional benefits to society generated by increased investment.

1. A Policy Dilemma

The conflicting conclusions pose a dilemma. The implementation of policies which pursue society's overall economic well-being places the individual pension plan contributor at an apparent disadvantage. On the other hand, the price of implementing policies which lower the individual's perception of the cost of pensions is the foregoing of increased collective well-being.

Pay-as-you-go financing delivers pension benefits at the lowest financial cost. This is a strong and persuasive rationale for pay-as-you-go financed national pension plans. Further, if contributions to employer-sponsored plans become more significant, the relatively lower contribution rates associated with an expanded CPP/QPP or even an amalgamated pay-as-you-go private pension system become more appealing.

From the economic perspective investment fund financing is preferred. The total value of economic benefits accruing to society from additional capital investment exceeds the value of reduced pension plan contributions under pay-as-you-go financing.

Unfortunately, the external portion of the total return to investment fund financing is not identifiable by individual contributors. This puts the economic solution at a practical disadvantage. Further, even if the external return is recognized, its impact on individual preferences is not clear since it would only indirectly benefit plan participants. While pay-as-you-go financing produces an identifiable reduction in contribution rates, an individual's share of the external benefit is elusive and therefore may have less impact on the process of policy formulation.

Appendix

Aggregate Earnings and Employment — Table 1

Year	Wages & Salaries & Supplementary Labour Income	Total Civilians Employed	Non-Agric'l Employed
	($ million)	(000)	(000)
1951	10,538	5,097	4,158
1952	11,768	5,169	4,278
1953	12,714	5,235	4,377
1954	13,043	5,243	4,365
1955	13,930	5,364	4,546
1956	15,696	5,585	4,808
1957	16,988	5,731	4,983
1958	17,435	5,706	4,988
1959	18,596	5,870	5,170
1960	19,582	5,965	5,282
1961	20,399	6,055	5,374
1962	21,816	6,225	5,565
1963	23,262	6,375	5,726
1964	25,367	6,609	5,979
1965	28,201	6,862	6,268
1966	31,878	7,242	6,609
1967	35,303	7,451	6,820
1968	38,444	7,593	6,992
1969	43,065	7,832	7,245
1970	46,706	7,919	7,406
1971	51,528	8,107	7,592
1972	57,570	8,363	7,878
1973	66,757	8,802	8,331
1974	80,086	9,185	8,709
1975	93,289	9,363	8,877
1976	107,914	9,572	9,098

Source: CANSIM Data Base: D0030001, D0031252, D0031250.

McLeod Young Weir Bond Averages — Table 2
(per cent)

Year	Total Bond Yield Averages (—40 Years)[1]	Industrial Bond Yield Averages (—10 Years)	Municipal Bond Yield Averages (—10 Years)	Provincial Bond Yield Averages (—10 Years)
1952	4.32	4.29	4.64	4.12
1953	4.42	4.50	4.65	4.14
1954	3.90	4.10	3.92	3.49
1955	3.71	3.99	3.74	3.42
1956	4.39	4.61	4.69	4.26
1957	5.28	5.37	5.49	4.98
1958	4.93	5.00	5.16	4.75
1959	5.71	5.62	5.99	5.64
1960	5.76	5.70	6.00	5.65
1961	5.52	5.48	5.71	5.49
1962	5.52	5.45	5.70	5.50
1963	5.47	5.37	5.59	5.43
1964	5.55	5.50	5.67	5.53
1965	5.67	5.68	5.75	5.59
1966	6.41	6.50	6.46	6.29
1967	6.92	7.09	6.95	6.70
1968	7.77	7.92	7.80	7.60
1969	8.65	8.75	8.84	8.40
1970	9.23	9.18	9.44	9.04
1971	8.29	8.35	8.30	8.03
1972	8.28	8.30	8.35	8.13
1973	8.47	8.47	8.54	8.36
1974	10.13	10.17	10.22	9.91
1975	10.59	10.76	10.70	10.17
1976	10.35	10.48	10.40	10.11

[1]Refers to maturity.
Source: CANSIM Data Base: B0014031, B0014016, B0014015, B0014014.

Federal Bond Yields

Table 3

(per cent)

Year	Government of Canada Bond Yield Averages (+10 Year)	Average Interest Rates Earned by CPP Investment Fund[1]
1952	3.56	—
1953	3.71	—
1954	3.18	—
1955	3.14	—
1956	3.63	—
1957	4.11	—
1958	4.11	—
1959	5.07	—
1960	5.19	—
1961	5.05	—
1962	5.11	—
1963	5.09	—
1964	5.18	—
1965	5.21	—
1966	5.69	5.44
1967	5.94	5.65
1968	6.75	6.59
1969	7.58	7.38
1970	7.91	8.07
1971	6.95	7.14
1972	7.23	7.26
1973	7.56	7.46
1974	8.90	8.39
1975	9.04	8.87
1976	9.16	9.06

[1]Department of Finance Canada (1966 average determined for last 10 months of 1966).
Source: CANSIM Data Base: B0014013.

Mortgages and Equities

Table 4

Year	Conventional Mortgage Rate	Common Stock Index[1]
	(%)	
1951	—	209.22
1952	5.77	208.56
1953	5.97	207.02
1954	6.01	239.45
1955	5.88	332.19
1956	6.23	395.99
1957	6.85	396.58
1958	6.80	395.37
1959	6.98	473.23
1960	7.18	457.66
1961	7.00	599.48
1962	6.97	595.77
1963	6.97	659.95
1964	6.97	807.02
1965	7.02	900.89
1966	7.66	866.63
1967	8.07	931.76
1968	9.06	985.94
1969	9.84	1126.97
1970	10.45	1060.00
1971	9.43	1154.75
1972	9.21	1385.74
1973	9.59	1522.21
1974	11.24	1325.57
1975	11.43	1372.12
1976	11.78	1472.56

[1]Patterson, J., "Report of Committee on Economic Statistics: Statistical Data 1924-1976", Meeting of the Canadian Institute of Actuaries (mimeo: Montreal, 1977).
Source: CANSIM Data Base: B0014024.

Nominal and Real Aggregate Earnings — Table 5

Year	Nominal Earnings	Consumer Price Index	Real Earnings
	($ million)		($ million)
1964	25,367	78.6	32,274
1965	28,201	80.5	35,032
1966	31,878	83.5	38,177
1967	35,303	86.5	40,813
1968	38,444	90.0	42,716
1969	43,065	94.1	45,765
1970	46,706	97.2	48,051
1971	51,528	100.0	51,528
1972	57,570	104.8	54,933
1973	66,757	112.7	59,234
1974	80,086	125.0	64,069

Source: CANSIM Data Base: D0030001, D0626101.

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